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Effects of Positive and Negative Self-Talk on Balance and Postural Sway in College Students

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Abstract

Self-talk pertains to phrases individuals recite aloud or internally to increase motivation and focus and is a frequently used psychological skill that promotes enhanced sport performance. Several studies have examined how different these forms of self-talk can affect the execution of specific tasks in sport, but few have examined if self-talk can improve performance in basic activities of daily living, such as balance. The purpose of this study was to examine the effects of two different self-talk strategies on static balance and body stability during a single-leg balance task. Twenty-nine participants were divided into three groups (control group, positive self-talk group, negative self-talk group) and performed a single-leg balance task on the right and left leg while donning inertial measurement units and standing on a force platform and while reciting a positive, negative, or no self-talk strategy (i.e., control). No significant differences ($p > 0.05$) were detected in the anterior-posterior center of pressure displacement and velocity, and the anterior-posterior center of mass displacement and velocity of the right and left legs. The findings of this study do not suggest that positive or negative self-talk impacts performance during a single-leg balance task.

Keywords: self-talk, motivation, balance, fall prevention, kinematics

1 Introduction

Self-talk or inner speak addressed to the self, pertains to phrases or statements individuals recite aloud or internally to increase motivation and focus (Hardy et al., 2009). This strategy has been a frequently used psychological skill (Munroe-Chandler & Hall, 2016) and has long been used to enhance performance in sports (Hardy et al., 2009). Much of the self-talk literature stems from the sport domain, with studies reporting that 85% of adult athletes engage in self-talk during sport-related activities (Nedergaard et al., 2021). The literature has widely examined self-talk, and considerable progress has been achieved in explaining the mechanisms surrounding self-talk and its influence on performance. It is primarily based on the principle that what people say to themselves and how they say it affects performance-related outcomes (Ellis, 1976; Johnson et al., 2004). As a result, self-talk has become an integral part of psychological training (Hardy et al., 1996; Hardy et al., 2008), and there is evidence to support the effectiveness of self-talk in improving learning and task performance (Bunker et al., 1993). Self-talk can enhance attentional focus (Landin Hebert, 1999), and self-talk can effectively redirect focus and attention to relevant cues needed for task success (Nideffer Sagal, 1993). Moreover, several arguments have been made in support of self-talk and its potential to regulate effort (Williams et al., 2015), enhance self-confidence (Williams et al., 2015), and reduce performance anxiety (Hardy et al., 1996). Hardy (2006) proposed that self-talk is comprised of six dimensions: 1) function (motivational or instructional), 2) valence (positive or negative), 3) overtness (out loud or in your head), 4) self-determination level (assigned or unassigned), 5) motivation level (motivating or unmotivating), and 6) frequency (Hardy, 2006). However, sport literature has predominantly focused on the function (i.e., motivational vs. instructional) and valence (i.e., positive vs. negative) of self-talk (Hardy et al., 2001). Motivational self-talk is designed in a way that is meant to increase confidence, effort, energy expenditure, and focus by creating a positive mood (Anderson et al., 1999). A study by Hatzigeorgiadis et al., 2008) examined the effects of motivational self-talk on self-efficacy and performance in tennis players and found that the athletes who utilized their motivational phrase performed significantly better and had improved self-efficacy scale scores compared to the control group, suggesting that motivational self-talk might be best for enhancing performance during gross-motor task. Landin and Hebert (1999) examined the effects of instructional self-talk and found tennis players' use of instructional self-talk cues led to improvements in their volleying performance. Therefore, instructional self-talk might improve performance during fine motor tasks (Hatzigeorgiadis Biddle, 2008). Several studies have examined how these different forms of self-talk can affect the execution of specific tasks in sports, such as golf swings, tennis swings, free throw shooting, dart throwing, and even cycling performance. Given the abundance of self-talk literature in sports, a meta-analysis of such interventions revealed a positive moderate effect size (d= 0.48; Hatzigeorgiadis et al., 2011). It was also found that self-talk interventions were more effective for fine-motor tasks involving hand-eye coordination, accuracy, and precision (Hatzigeorgiadis Biddle, 2008). Ultimately, instructional self-talk (as opposed to motivational self-talk) was most beneficial in performing fine-motor tasks. Motivational and instructional self-talk represent umbrella categories under which other subsets or variations of these self-talk strategies exist. Regarding valence among these subsets, one such category is positive self-talk. Athletes use positive self-talk statements to boost morale and enhance confidence, anxiety control, and instruction (Zourbanos et al., 2009). Negative self-talk, on the other hand, consists of worry, disengagement, somatic fatigue, and irrelevant thoughts (Zourbanos et al., 2009). Generally, positive self-talk strategies have been implemented, and overall, the findings indicate that positive self-talk can improve sports performance (Edwards et al., 2008; Hatzigeorgiadis et al., 2008; Landin Hebert, 1999; Miles Neil, 2013; Tod et al., 2009). In recent decades, researchers have examined the effects of negative self-talk with mixed results (Hatzigeorgiadis, 2008). Studies have reported deficits in task performance associated with negative self-talk strategies, while others have reported performance benefits stemming from using this strategy. Hatzigeorgiadis and Biddle (2008) examined how negative self-talk impacted running race performance anxiety. They found that athletes who reported using negative self-talk also encountered significantly higher levels of cognitive anxiety during competition, presumably leading to unfavorable performance. However, the study also revealed that athletes who reported less use of negative self-talk identified their race anxiety as facilitative rather than debilitative (Hatzigeorgiadis Biddle, 2008). Another study by Van Raalte et al. (1995) examined the effects of negative self-talk on dart-throwing performance. Participants who reported using negative self-talk displayed a significant decrease in throwing accuracy compared to a positive self-talk and control group. Identical findings were reported by (Dagrou et al., 1992), which showed that participants who utilized negative self-talk had higher error rates in dart throwing compared to a control and positive self-talk groups. Interestingly, Van Raalte et al. (1995) also identified that the negative self-talk group had significantly better expectations for future throwing performance, suggesting that negative self-talk might possess a motivating factor to enhance performance (Van Raalte et al., 1995), and both positive and negative self-talk can improve cognitive performance through different brain alterations linked to motivation (Kim et al., 2021). Given the positive effects of self-talk on enhancing sports performance, there has been growing interest in using this skill in the exercise domain. Yet, many have focused on sport-specific skills and the techniques needed to deliver specific movements, such as throwing or soccer shooting (Anderson et al., 1999; Hamilton et al., 2007). Others have also examined how self-talk can impact metabolic expenditure and endurance during anaerobic and aerobic activity (Hamilton et al., 2007; Wallace et al., 2017). The fact remains that only four studies (Araki et al., 2006; Beneka et al., 2013; Rai et al., 2015; Saebi et al., 2016) have examined how self-talk can improve performance in basic activities of daily living, specifically control of static and dynamic balance, which are essential skills needed to perform complex tasks, such as walking and navigating the environment. Araki and colleagues (2006) examined various self-talk strategies on balance performance among healthy undergraduate students. Compared to a control group, they detected improvements in balance associated with positive and negative self-talk. However, participants using a positive strategy still performed better than those in the negative self-talk group. The study by (Beneka et al., 2013) examined the influence of motivation and instructional self-talk in individuals with knee injuries and found that those who used the self-talk strategies performed significantly better on timed balance board tests. The study by (Rai et al., 2015) examined persons with intellectual disabilities and found that motivational and instructional self-talk significantly improved performance on static and dynamic balance measures. Finally, Saebi et al. (2016) examined the effects of educational self-talk on Berg Balance Scale performance. They found that self-talk was effective in improving performance among women with multiple sclerosis. These studies further emphasize the need to examine the potential effects of self-talk strategies for balance and stability in other populations. One specific task that warrants further investigation is the single-leg balance task (Araki et al., 2006), which closely relates to the single-support phase of gait (Honda et al., 2023; Jung et al., 2014). As age-related changes become more apparent, some individuals may experience decreases in single-leg balance task duration from 22 to 14 seconds, which may translate to decreased single leg-support during walking, leading to shuffled gait and diminished gait speed (Blodgett et al., 2022; Honda et al., 2023; Murray et al., 1969; Springer et al., 2007). These characteristics are prevalent in populations displaying gait deficits, such as stroke, multiple sclerosis, Parkinson's, and older adults (Jerome et al., 2015; Torchio et al., 2022). Therefore, the purpose of this feasibility study was to examine the effects of two different self-talk strategies on static balance and body stability during a single-leg balance task among healthy adults. It was hypothesized that self-talk strategies would impact balance task performance differently. Specifically, negative self-talk would negatively impact balance, while positive self-talk would improve balance, compared to the control group.

2 Methods

2.1 Participants

An a priori sample estimate of 36 participants (12/group) with a critical alpha-level of 0.05, a large effect size (d= 0.98), and a power of 0.80 was calculated in G-Power 3.1(Faul et al., 2007) using historical data (Beneka et al., 2013). Thirty college-aged adults with no history of neurological, cognitive, musculoskeletal, cardiovascular, or known gait or balance impairments were recruited. Twenty-nine participants completed the study (Table 1). Before any study sessions, participants provided written informed consent approved by the Institutional Review Board. Following consent, participants were randomly assigned into one of three groups: a control group (CON n = 9), a positive self-talk group (PST n = 10), or a negative self-talk (NST n =10) group using a random number generator and were briefed on all procedures. This study utilized one between-group factor with three levels (CON, PST, or NST) and one within-group "time" factor with two levels (pre-test and post-test). All procedures followed the ethical standards described by the 1964 Declaration of Helsinki.

2.2 Procedures

2.2.1 Warm-up & Anthropometrics

All study visits took place in the biomechanics laboratory located on campus. Upon providing written informed consent and being assigned to groups, participants completed a five-minute treadmill warm-up (Intenza Model 550Te2, Redmond, WA) at a self-selected casual walking pace. Participants selected a walking pace that mimicked "walking through the aisles of a marketplace," and this was performed under the supervision of two research staff members. Once completed, participants completed a battery of anthropometric measurements including body height and body composition (i.e., mass (kg), fat%, and body mass index (BMI)) using a bioelectrical impedance analysis (TBF-400, Tanita, Arlington Heights, IL). These pre-test procedures took approximately 10 minutes to complete. Following the warm-up and anthropometrics, participants were briefed on the study procedures and self-talk strategies for their group assignments.

2.2.2 Self-talk Protocol

To assess the effects of self-talk valance, this protocol utilized two strategies (positive and negative self-talk) and a control group (i.e., no self-talk) while performing the single-leg balance task on the right and left leg. Participants in the control group performed all balance tasks discussed previously with no self-talk strategy. The negative self-talk group participants completed the balance tasks using the following negative statement

("I am terrible at keeping my balance"). The positive self-talk group participants completed the balance tasks using the following positive statement ("I am great at keep my balance"). Participants in the PST and NST groups were instructed to employ their respective strategies aloud during the 30-second balance trial window and in their natural tone during the 30-second balance trial window. Regarding frequency, participants were required to recite their respective strategies at least ten times within the 30-second trial. They were given time to acclimate to the study environment before commencing the self-talk protocol, which lasted one hour.

2.2.3 Assessment of Central of Pressure

The posturography test quantified the balance during two different balance tasks by measuring spontaneous body sway as the participant stood on a portable force plate (ACS-00, AMTI, Watertown, MA). All participants completed a pre-test session in which they performed the single-leg left (SLL) and single-leg right (SLR) balance tasks. The body was kept upright, with arms along the sides of the body. Participants were instructed to stand as still as possible during the test. Three 30-second trials were tested sequentially for the right and left leg. In each condition, the body sway (mm) in both anteroposterior and mediolateral direction was calculated as the maximum anteroposterior and mediolateral excursion of the center of pressure, obtained from the ground reaction force data gathered by the portable force plate. The average body sway velocity was also calculated as the total sway displacement for the time in the trial.

2.2.4 Assessment of Postural Stability

Postural stability was evaluated for all participants during the completion of the balance tasks. During all balance trials, a motion analysis system (Movella, Amsterdam, ND) recording at 60 Hz was used to record the positions of feet, ankles, knees, hips, shoulders, elbows, and wrists at known landmarks. Motion data were subsequently used to compute the body center of mass (COM) displacement-velocity trajectory using known segmental parameter information.

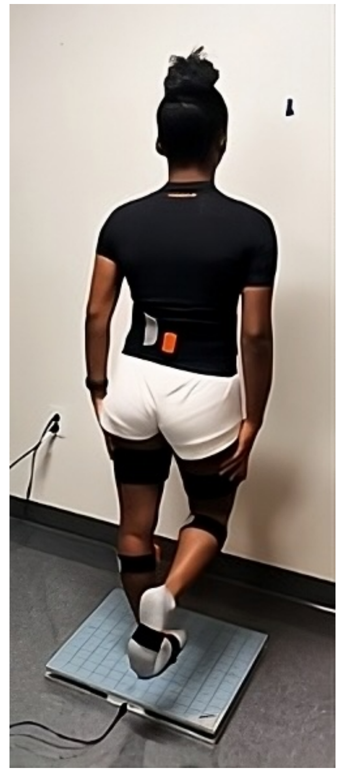

Figure 1: Experimental Set-up: Participant set-up for the single-leg balance task with participant donning inertial measurement units and demonstrating the standing task on the portable force platform.

2.3 Statistical Analyses

Data were analyzed using SPSS version 26.2. A 2 x 3 ANOVA was used to identify the potential effect of the self-talk strategies upon improving balance performance within each population (positive self-talk, negative self-talk, control). The within-subject factor is the time instants (pre-test vs. post-test) with three between-subject factors [self-talk types: (positive self-talk, negative self-talk, and control)]. For all analyses, an alpha level of $p < 0.05$ was used to determine statistical significance, and post-hoc Bonferroni corrected pair-wise comparisons were performed on significant effects if identified.

3 Results

3.1 Participants

Twenty-nine participants completed the study and reported no adverse effects. Pre-test characteristics are presented in Table 1. The Chi-Square Test showed no differences in sex between groups ($p > 0.05$), and a one-way analysis of variance (ANOVA) revealed no differences between groups in age (yrs.), height (m), or mass (kg), or body mass index (kg/m^2; $p > 0.05$).

3.2 Center of Pressure and Center of Mass Outcomes

The 2×3 ANOVA revealed no significant differences ($p > 0.05$) of the right leg at pre-test (no strategy) between groups when examining anterior-posterior center of pressure displacement $F(2, 26) = 0.26$, $p = 0.77$, $\eta_p^2 = 0.02$ and velocity $F(2, 26) = 0.29$, $p = 0.75$, $\eta_p^2 = 0.02$, and anterior-posterior center of mass displacement $F(2, 26) = 0.63$, $p = 0.54$, $\eta_p^2 = 0.05$ and velocity $F(2, 26) = 1.87$, $p = 0.17$, $\eta_p^2 = 0.13$. Additionally, no significant findings were observed for the left leg at pre-test for the variables mentioned above $F(2, 26) = 0.15$, $p = 0.85$, $\eta_p^2 = 0.01$, $F(2, 26) = 0.64$, $p = 0.53$, $\eta_p^2 = 0.04$, $F(2, 26) = 0.52$, $p = 0.59$, $\eta_p^2 = 0.03$, and $F(2, 26) = 0.90$, $p = 0.41$, $\eta_p^2 = 0.06$, respectively. When utilizing their respective self-talk strategies, no significant differences ($p > 0.05$) were detected for the right leg in the anterior-posterior center of pressure displacement $F(2, 26) = 1.35$, $p = 0.27$, $\eta_p^2 = 0.09$ and velocity $F(2, 26) = 1.73$, $p = 0.19$, $\eta_p^2 = 0.11$, and anterior-posterior center of mass displacement $F(2, 26) = 0.004$, $p = 0.99$, $\eta_p^2 = 0.01$ and velocity $F(2, 26) = 0.33$, $p = 0.72$, $\eta_p^2 = 0.02$. Additionally, no significant findings were observed for the left leg when utilizing their respective self-talk strategies for the variables described above, $F(2, 26) = 0.91$, $p = 0.42$, $\eta_p^2 = 0.06$, $F(2, 26) = 0.31$, $p = 0.73$, $\eta_p^2 = 0.02$, $F(2, 26) = 0.04$, $p = 0.95$, $\eta_p^2 = 0.003$, and $F(2, 26) = 0.56$, $p = 0.57$, $\eta_p^2 = 0.04$. The analyses also revealed no significant ($p > 0.05$) within-group differences among these variables when comparing left and right stances during the pre-test or while utilizing the respective strategies. Mean and standard error values are displayed in Figure 2-4.

4 Discussion

The purpose of this study was to examine the effects of two different self-talk strategies on balance during single-leg balance task performance. The results showed no performance effects associated with negative or positive self-talk; no benefits or decrements were observed between or within groups. These results did not support the hypothesis that negative self-talk would negatively impact balance, while positive self-talk would improve balance, compared to the control group. These findings are not aligned with most previous reports, which showed self-talk valence (positive or negative) can have a directional impact on motor task performance. An early study by (Dagrou et al., 1992) examined the effects of positive and negative self-talk on dart-throwing accuracy and found a clear distinction in performance when comparing negative and positive self-talk groups. The authors determined that throwing accuracy increased in the positive self-talk group, whereas accuracy decreased in the negative self-talk group. Although a gross motor task was used (Dagrou et al., 1992) like the present study, the self-talk strategies in each study were delivered differently. The participants recited their respective self-talk strategies in between rounds of throwing (Dagrou et al., 1992), whereas the participants in the current study verbalized their self-talk strategies during the actual motor task (e.g., balance). These differences might provide insight into the results achieved, but this requires further investigation. A later study by (Araki et al., 2006) examined the effects of various self-talk strategies on balance performance while standing on a stabilometer. It detected that participants using a self-talk strategy improved overall balance compared to a control group. However, a positive self-talk strategy produced longer periods of stability while standing on the stabilometer than the negative self-talk group, 9.28 seconds and 7.30 seconds, respectively. Although similar to our study, the participants in the study by Araki and colleagues (2006) adopted a bipedal stance while standing on the stabilometer. This stabilometer was elevated approximately 22 centimeters from the floor and tilted five degrees from the horizontal plane. A more recent study by (DeWolfe et al., 2021) determined that participants in a negative self-talk group performed much worse during the latter portion of a cycling task than participants in a motivation, neutral, and challenging group. Unlike our study, this study identified that when paired with a challenging self-talk statement (i.e., I can push through it), negative self-talk resulted in better cycling performance than negative self-talk alone. The authors stated that this finding might have resulted from participants in the negative (plus challenging) self-talk group internalizing portions of the negative self-talk statement and possibly perceiving the negative statement as challenging (i.e., I can push through it), which led to

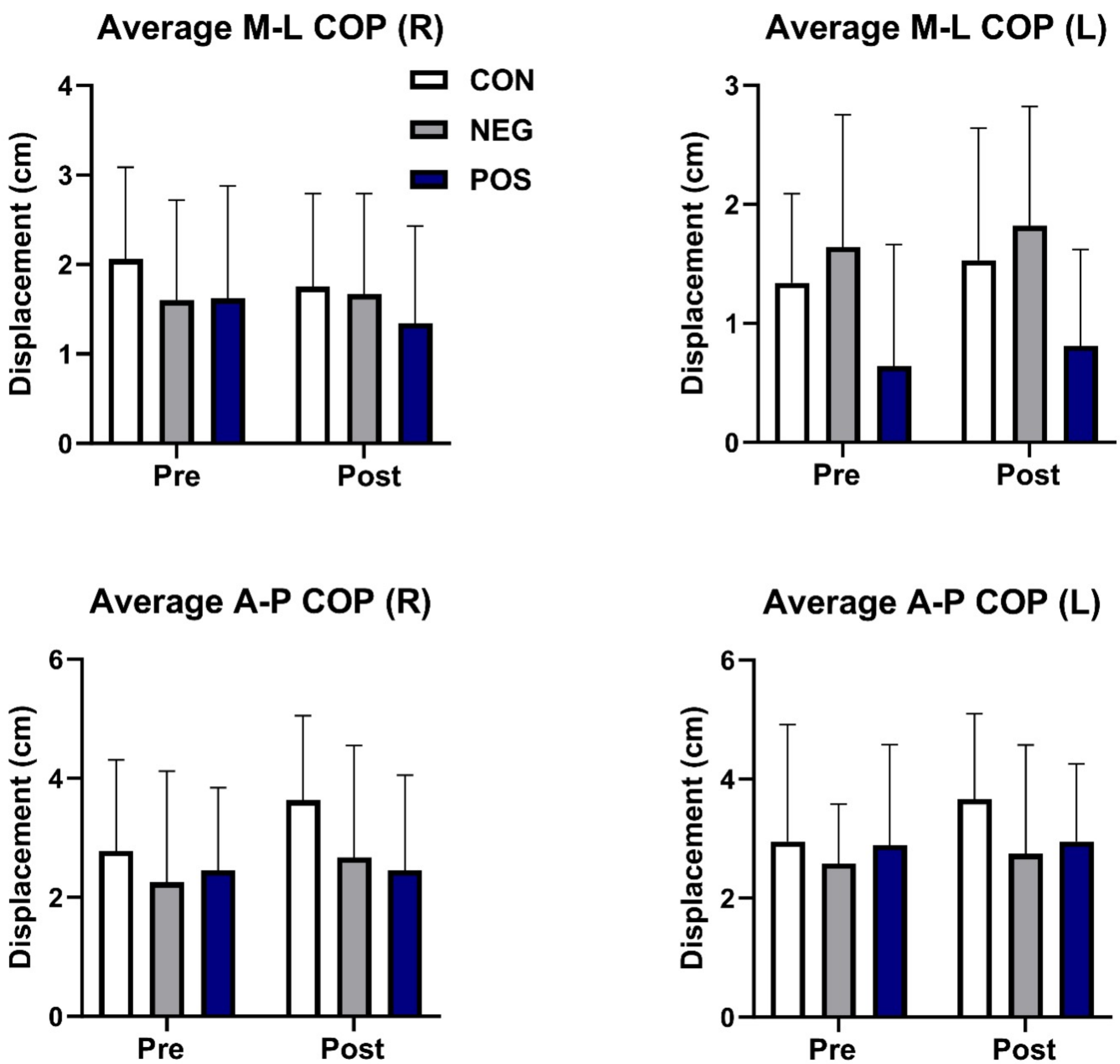

Figure 2: Participant Center of Pressure Displacement: Group means and standard error bars for the center of pressure displacement (cm) in the medial-lateral (M-L) and the anterior-posterior (A-P) direction for the right and left legs.

Table 1: Demographics for participants in the control, positive, and negative self-talk groups.

Parameter	CON (n = 9)	PST (n = 10)	NST (n = 10)	p-value
Age (years)	19.11 ± 1.05	19.70 ± 0.67	19.40 ± 1.07	0.41
Sex (female)	3	7	6	0.25
Body height (m)	1.69 ± 0.14	1.70 ± 0.11	1.69 ± 0.07	0.97
Body mass (kg)	86.03 ± 29.35	69.34 ± 20.58	77.91 ± 13.15	0.26
BMI (kg/m^2)	30.20 ± 10.72	23.67 ± 4.30	27.50 ± 5.06	0.15

Note. Values are n, mean ± standard deviation, or as otherwise indicated. One-way ANOVA and Pearson chi-squared test.

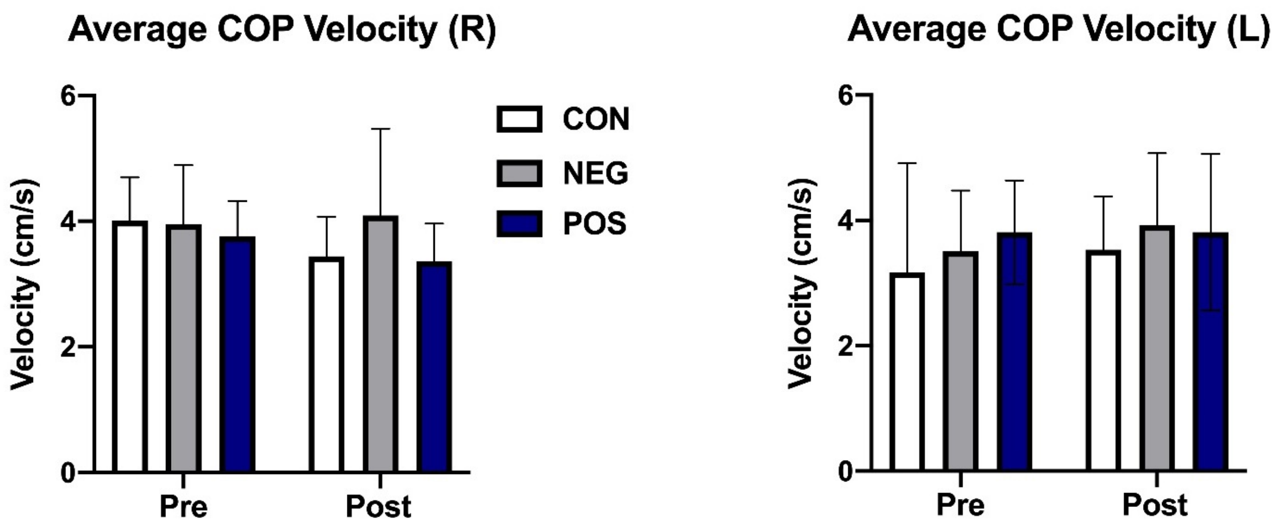

Figure 3: Participant Center of Pressure Velocity: Group means and standard error bars for the center of pressure velocity for the right and left legs.

improved performance. Additionally, participants could perceive a motivational component of negative self-talk, which could enhance performance (Hardy et al., 2009), and negative self-talk could promote a challenge state, which has been associated with improved motor task performance (Hase et al., 2019). Regarding self-talk type (i.e., motivational vs. instructional), Hatzigeorgiadis and colleagues (2014) proposed a matching hypothesis. When the task context involves fine motor skills, performers should use instructional self-talk, whereas if gross motor skills are being assessed, motivational self-talk can be more effective (Hatzigeorgiadis et al., 2014). Some evidence has been provided to support this matching hypothesis (Bellomo et al., 2020; Chang et al., 2014; Hardy et al., 2015; Hatzigeorgiadis et al., 2011). For example, throwing accuracy was better when participants used instructional self-talk, whereas the throwing distance was greater with motivational self-talk (Chang et al., 2014; Hatzigeorgiadis et al., 2004). Additionally, motivational self-talk enhanced push-up performance (Kolovelonis et al., 2011), an endurance task (Theodorakis et al., 2000), and power output in kinetic outcomes of the vertical jump (Edwards et al., 2008) to a greater extent than did instructional self-talk. The effects of motivational and instructional self-talk on dynamic balance in people with knee injuries were examined. Both strategies were effective in improving performance in the gross-motor task (e.g., dynamic balance), with no significant between-group differences (Beneka et al., 2013). It is important to note that although some of the research above

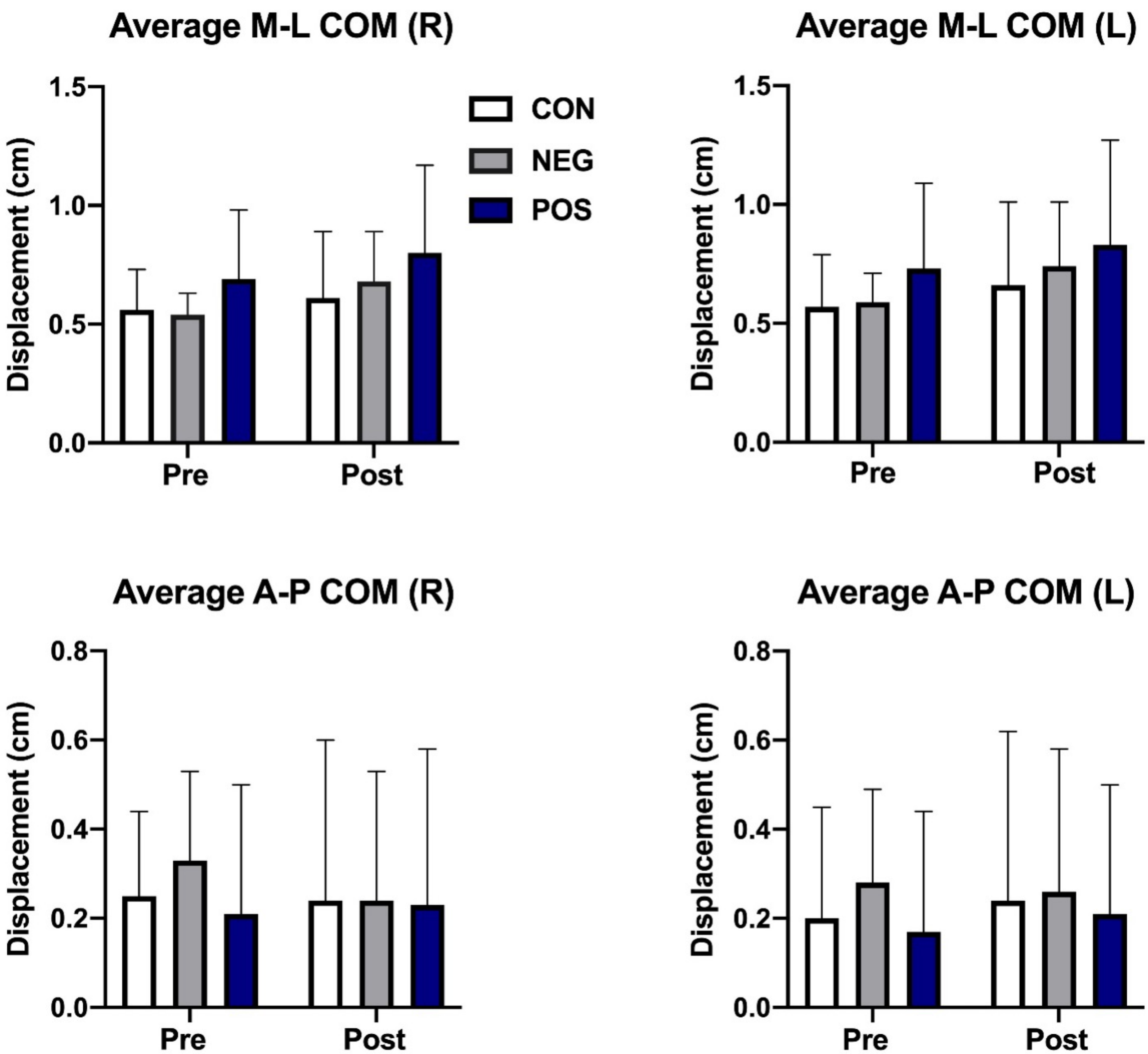

Figure 4: Participant Center of Mass Displacement: Group means and standard error bars for the center of mass displacement (cm) in the medial-lateral (M-L) and the anterior-posterior (A-P) direction for the right and left legs.

supports the matching hypothesis, the findings are not unequivocal. The findings described previously suggest that strategy-type selection is essential and primarily depends on the task demands and desired outcome. Single-leg balance performance was the desired outcome of the present study. It was interesting as this represents a vital phase in the gait cycle (i.e., single-support) where individuals are at high risk for stability loss (Honda et al., 2023; Riva et al., 2013). Several studies have indicated that the single-support phase of the gait cycle, particularly among older adults in the seventh and eighth decade, requires more intervention. As mentioned, this is mainly due to significant decreases in single-support phase duration, leading to gait modifications that can increase the risk for balance loss (Honda et al., 2023; Murray et al., 1969). Although only college-aged participants were involved in the present study, the experimental design must assess the efficacy and feasibility of utilizing positive and negative self-talk to enhance balance performance in at-risk populations. For example, approximately 80% of older participants show a deficit in balance control during the single-support phase of locomotion, especially in the seventh and eighth decade (Honda et al., 2023; Murray et al., 1969). The limited studies have looked specifically at the single-leg balance task while testing self-talk strategies (Beneka et al., 2013), and only one other has examined the effects of self-talk on balance performance in healthy college-aged adults (Araki et al., 2006), which also focused on bipedal stance. In all, four studies have examined the effects of self-talk on balance in some regards and have focused on very specific populations, including healthy college students (Araki et al., 2006), knee-injured individuals (Beneka et al., 2013), individuals with intellectual disabilities (Rai et al., 2015), and finally, women with multiple sclerosis (Saebi et al., 2016). Apart from these four studies, the effects of self-talk have almost exclusively looked at performance outcomes in sports or physical activity (i.e., running or jumping). Our study is the first to examine the impact of positive and negative self-talk strategies on a single-leg balance task. Additionally, since the effect of self-talk on biomechanical analysis has been lacking (Iwatsuki Van Raalte, 2022), this work will add a body of literature through biomechanical analysis on the effect of self-talk. Some limitations in this study might have impacted our overall findings. The self-talk strategies had a minimal self-determination component and were brief, possibly hindering any changes in performance between the groups (Hardy, 2006; Hase et al., 2019). Furthermore, the self-talk strategies were not modified throughout the visit. They lacked systematic control, meaning that if participants felt a performance improvement or decrement, they would still be required to repeat the same phrase without adaptations. Future studies will aim to improve the phrasing of the positive and negative self-talk statements to align more with each participant's personal preferences, performance needs, and changes (Hardy, 2006). Finally, although no significant differences were detected between groups in this study, whether changes were associated with the self-talk strategies or simply a practice effect remains to be investigated. The participants were given time to acclimate to the testing environment and then completed several repetitions of the single-leg task on the right and left legs as part of the protocol. In conclusion, the findings of this study do not suggest that positive or negative self-talk impacts performance during a single-leg balance task. Given the existing body of literature opposing these results, future studies must assess whether positive or negative self-talk strategies can be used as tools to potentially enhance single-leg stance balance. Future studies will aim to refine current methods, as the single-leg balance is a vital activity of everyday living that needs further investigation. This is particularly true for future applications of the self-talk strategy among older adults and other populations with gait deficits.

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Conflict of Interest

We have no conflicts of interest to disclose.

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References

Anderson, A., Vogel, P., & Albrecht, R. (1999). The effect of instructional self-talk on the overhand throw. *Physical Educator*, *56*(4), 215.

Araki, K., Mintah, J., Mack, M., Huddleston, S., Larson, L., & Jacobs, K. (2006). *Belief in Self-Talk and Dynamic Balance Performance*, *8*(24), 1–12.

Bellomo, E., Cooke, A., Gallicchio, G., Ring, C., & Hardy, J. (2020). Mind and body: Psychophysiological profiles of instructional and motivational self-talk. *Psychophysiology*, *57*(9), 1–14.

Beneka, A., Malliou, P., Gioftsidou, A., Kofotolis, N., Rokka, S., Mavromoustakos, S., & Godolias, G. (2013). Effects of instructional and motivational self-talk on balance performance in knee injured. *European Journal of Physiotherapy*, *15*(2), 56–63. https://doi.org/10.3109/21679169.2013.776109

Blodgett, J., Hardy, R., Davis, D., Peeters, G., Kuh, D., & Cooper, R. (2022). One-legged balance performance and fall risk in mid and later life: Longitudinal evidence from a british birth cohort. *American Journal of Preventive Medicine*, *63*(6), 997–1006. https://doi.org/10.1016/j.amepre.2022.07.002

Bunker, L., Williams, J., & Zinsser, N. (1993). Cognitive techniques for improving performance and building confidence. *Applied Sport Psychology: Personal Growth to Peak Performance*, *2*(1), 225–242.

Chang, Y., Ho, L., Lu, F., Ou, C., Song, T., & Gill, D. (2014). Self-talk and softball performance: The role of self-talk nature, motor task characteristics, and self-efficacy in novice softball players. *Psychology of Sport and Exercise*, *15*(1), 139–145.

Dagrou, E., Gauvin, L., & Halliwell, W. (1992). The effects of positive, negative and neutral self-talk on motor performance. *Canadian Journal of Sport Sciences= Journal Canadien Des Sciences Du Sport*, *17*(2), 145–147.

DeWolfe, C., Scott, D., & Seaman, K. (2021). Embrace the challenge: Acknowledging a challenge following negative self-talk improves performance. *Journal of Applied Sport Psychology*, *33*(5), 527–540.

Edwards, C., Tod, D., & McGuigan, M. (2008). Self-talk influences vertical jump performance and kinematics in male rugby union players. *Journal of Sports Sciences*, *26*(13), 1459–1465.

Ellis, A. (1976). *Reason and emotion in psychotherapy*. Lyle Stewart.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G* power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191.

Hamilton, R., Scott, D., & MacDougall, M. (2007). Assessing the effectiveness of self-talk interventions on endurance performance. *Journal of Applied Sport Psychology*, *19*(2), 226–239. https://doi.org/10.1080/10413200701230613

Hardy, C., Jones, G., & Gould, D. (1996). *Understanding psychological performance preparation for sport*. John Wiley e Sons Ltd.

Hardy, J. (2006). Speaking clearly: A critical review of the self-talk literature. *Psychology of Sport and Exercise*, *7*(1), 81–97. https://doi.org/10.1016/j.psychsport.2005.04.002

Hardy, J., Begley, K., & Blanchfield, A. (2015). It's good but it's not right: Instructional self-talk and skilled performance. *Journal of Applied Sport Psychology*, *27*, 132–139.

Hardy, J., Hall, C., & Alexander, M. (2001). Exploring self-talk and affective states in sport. *Journal of Sports Sciences*, *19*(7), 469–475.

Hardy, J., Hall, C., Gibbs, C., & Greenslade, C. (2005). Self-talk and gross motor skill performance: An experimental approach. *Athletic Insight*, *7*(2), 1–13.

Hardy, J., Oliver, E., & Tod, D. (2008). A framework for the study and application of self-talk within sport. In *Advances in applied sport psychology* (pp. 47–84).

Hardy, J., Roberts, R., & Hardy, L. (2009). Awareness and motivation to change negative self-talk. *The Sport Psychologist*, *23*(4), 435–450. https://doi.org/10.1123/tsp.23.4.435

Hase, A., Hood, J., Moore, L., & Freeman, P. (2019). The influence of self-talk on challenge and threat states and performance. *Psychology of Sport and Exercise*, *45*, 101550.

Hatzigeorgiadis, A. (2008). Negative self-talk during sport performance: Relationships with pre-competition anxiety and goal-performance discrepancies. *Journal of Sport Behavior*, *31*(3), 237–253.

Hatzigeorgiadis, A., Galanis, E., Zourbanos, N., & Theodorakis, Y. (2014). Self-talk and competitive sport performance. *Journal of Applied Sport Psychology*, *26*(1), 82–95.

Hatzigeorgiadis, A., Theodorakis, Y., & Zourbanos, N. (2004). Self-talk in the swimming pool: The effects of self-talk on thought content and performance on water-polo tasks. *Journal of Applied Sport Psychology*, *16*(2), 138–150.

Hatzigeorgiadis, A., Zourbanos, N., Galanis, E., & Theodorakis, Y. (2011). Self-talk and sports performance: A meta-analysis. *Perspectives on Psychological Science*, *6*(4), 348–356.

Hatzigeorgiadis, A., Zourbanos, N., Goltsios, C., & Theodorakis, Y. (2008). Investigating the functions of self-talk: The effects of motivational self-talk on self-efficacy and performance in young tennis players. *The Sport Psychologist*, *22*(4), 458–471.

Hatzigeorgiadis, A., Zourbanos, N., Mpoumpaki, S., & Theodorakis, Y. (2009). Mechanisms underlying the self-talk–performance relationship: The effects of motivational self-talk on self-confidence and anxiety. *Psychology of Sport and Exercise*, *10*(1), 186–192.

Honda, K., Sekiguchi, Y., & Izumi, S.-I. (2023). Effect of aging on the trunk and lower limb kinematics during gait on a compliant surface in healthy individuals. *Biomechanics*, *3*(1), 103–114. https://doi.org/10.3390/biomechanics3010010

Iwatsuki, T., & Raalte, J. (2022). The use of self-talk in closed self-paced motor tasks. In *The psychology of closed self-paced motor tasks in sports* (pp. 109–121).

Jerome, G., Ko, S., Kauffman, D., Studenski, S., Ferrucci, L., & Simonsick, E. (2015). Gait characteristics associated with walking speed decline in older adults: Results from the baltimore longitudinal study of aging. *Archives of Gerontology and Geriatrics*, *60*(2), 239–243.

Johnson, J., Hrycaiko, D., Johnson, G., & Halas, J. (2004). Self-talk and female youth soccer performance. *The Sport Psychologist*, *18*(1), 44–59.

Jung, J.-H., Ko, S.-E., & Lee, S.-W. (2014). Immediate effects of single-leg stance exercise on dynamic balance, weight bearing and gait cycle in stroke patients. *Physical Therapy Rehabilitation Science*, *3*(1), 49–54.

Kim, J., Kwon, J., Kim, J., Kim, E., Kim, H., Kyeong, S., & Kim, J.-J. (2021). The effects of positive or negative self-talk on the alteration of brain functional connectivity by performing cognitive tasks. *Scientific Reports*, *11*(1), 1–11. https://doi.org/10.1038/s41598-021-94328-9

Kolovelonis, A., Goudas, M., & Dermitzaki, I. (2011). The effects of instructional and motivational self-talk on students' motor task performance in physical education. *Psychology of Sport and Exercise*, *12*(2), 153–158.

Landin, D., & Hebert, E. (1999). The influence of self-talk on the performance of skilled female tennis players. *Journal of Applied Sport Psychology*, *11*(2), 263–282.

Miles, A., & Neil, R. (2013). The use of self-talk during elite cricket batting performance. *Psychology of Sport and Exercise*, *14*(6), 874–881.

Munroe-Chandler, K., & Hall, C. (2016). *Imagery*. Routledge International Handbook of Sport Psychology.

Murray, M., Kory, R., & Clarkson, B. (1969). Walking patterns in healthy old men. *Journal of Gerontology*, *24*(2), 169–178.

Nedergaard, J., Christensen, M., & Wallentin, M. (2021). Valence, form, and content of self-talk predict sport type and level of performance. *Consciousness and Cognition*, *89*, 1–17. https://doi.org/10.1016/j.concog.2021.103102

Nideffer, R., & Sagal, M.-S. (1993). Concentration and attention control training. *Applied Sport Psychology: Personal Growth to Peak Performance*, *2*, 243–261.

Rai, A., Sadeghi, H., & Bagherli, J. (2015). The effects and sustainability of self-talk and focus of attention with an 8-week training program on the balance in educable mentally-retarded female students (7-15 years old. *Journal of Novel Applied Science*, *4*(6), 694–702.

Riva, D., Mamo, C., Fanì, M., Saccavino, P., Rocca, F., Momenté, M., & Fratta, M. (2013). Single stance stability and proprioceptive control in older adults living at home: Gender and age differences. *Journal of Aging Research*, 1–14. https://doi.org/10.1155/2013/561695

Saebi, S., Khajavi, D., & Faraji, F. (2016). The effect of balance training with educational and motivational self-talk on balance in the women with multiple sclerosis. *Arak Medical University Journal (AMUJ*, *19*(115), 48–58.

Springer, B., Marin, R., Cyhan, T., Roberts, H., & Gill, N. (2007). Normative values for the unipedal stance test with eyes open and closed. *Journal of Geriatric Physical Therapy*, *30*(1), 8–15.

Theodorakis, Y., Weinberg, R., Natsis, P., Douma, I., & Kazakas, P. (2000). The effects of motivational versus instructional self-talk on improving motor performance. *The Sport Psychologist*, *14*, 253–272.

Tod, D., Thatcher, R., McGuigan, M., & Thatcher, J. (2009). Effects of instructional and motivational self-talk on the vertical jump. *The Journal of Strength Conditioning Research*, *23*(1), 196–202.

Torchio, A., Corrini, C., Anastasi, D., Parelli, R., Meotti, M., Spedicato, A., Groppo, E., D'Arma, A., Grosso, C., & Montesano, A. (2022). Identification of modified dynamic gait index cutoff scores for assessing fall risk in people with parkinson disease, stroke and multiple sclerosis. *Gait Posture*, *91*, 1–6.

Van Raalte, J., Brewer, B., Lewis, B., Linder, D., Wildman, G., & Kozimor, J. (1995). Cork! the effects of positive and negative self-talk on dart throwing performance. *Journal of Sport Behavior*, *18*(1), 50–58.

Wallace, P., McKinlay, B., Coletta, N., Vlaar, J., Taber, M., Wilson, P., & Cheung, S. (2017). Effects of motivational self-talk on endurance and cognitive performance in the heat. *Medicine Science in Sports Exercise*, *49*(1), 191–199.

Williams, J., Zinsser, N., & Bunker, L. (2015). Cognitive techniques for building confidence and enhancing performance. In *Applied sport psychology: Personal growth to peak performance* (pp. 274–303).

Zourbanos, N., Hatzigeorgiadis, A., Chroni, S., Theodorakis, Y., & Papaioannou, A. (2009). Automatic self-talk questionnaire for sports (astqs): Development and preliminary validation of a measure identifying the structure of athletes' self-talk. *The Sport Psychologist*, *23*, 233–251. https://doi.org/10.1123/tsp.23.2.233

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