

Effects of changing the scale of visual biofeedback on center of pressure

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Introduction

- Visual feedback has shown to minimize body sway during quiet standing (Freitas & Duarte, 2011).
- Visual feedback has also shown to activate voluntary balance control (Halická et al., 2013).
- Therefore, visual feedback improves neuromuscular coordination of the necessary muscles in postural control (Sayenko et al., 2012).
- However, research lacks to mention the optimal sensitivity parameters of the center of pressure (COP) adjustments given via visual biofeedback.
- The main purpose of this study was to determine the scale of sensitivity needed for optimal visual feedback.
- It was hypothesized that the body sway would be the least at 5x the intensity of the normal COP, but would be more variable at 10x.

Methods

- After providing informed consent, participants self-reported physical and demographic information (e.g., age, gender, falls over the past year, health status).
- The participants (6 males; 13 females; aged 21.26 ± 2.37) were then instructed to stand on a force platform with feet together (FT) as still as possible for 60 seconds. There were 3 biofeedback conditions in which participants were instructed to keep a square dot in a square box representing their center of pressure within the limits of square box in the middle of the screen. The 4 conditions consisted of:
 - No visual feedback (control condition)
 - COP on a regular scale (condition 1)
 - COP with the scale x5 (condition 2)
 - COP with the scale x10 (condition 3).
- The COPx, COPy, standard deviation in x, the standard deviation in y, the velocity and the area covered by the COP were later analyzed by ANOVA procedures.

Results

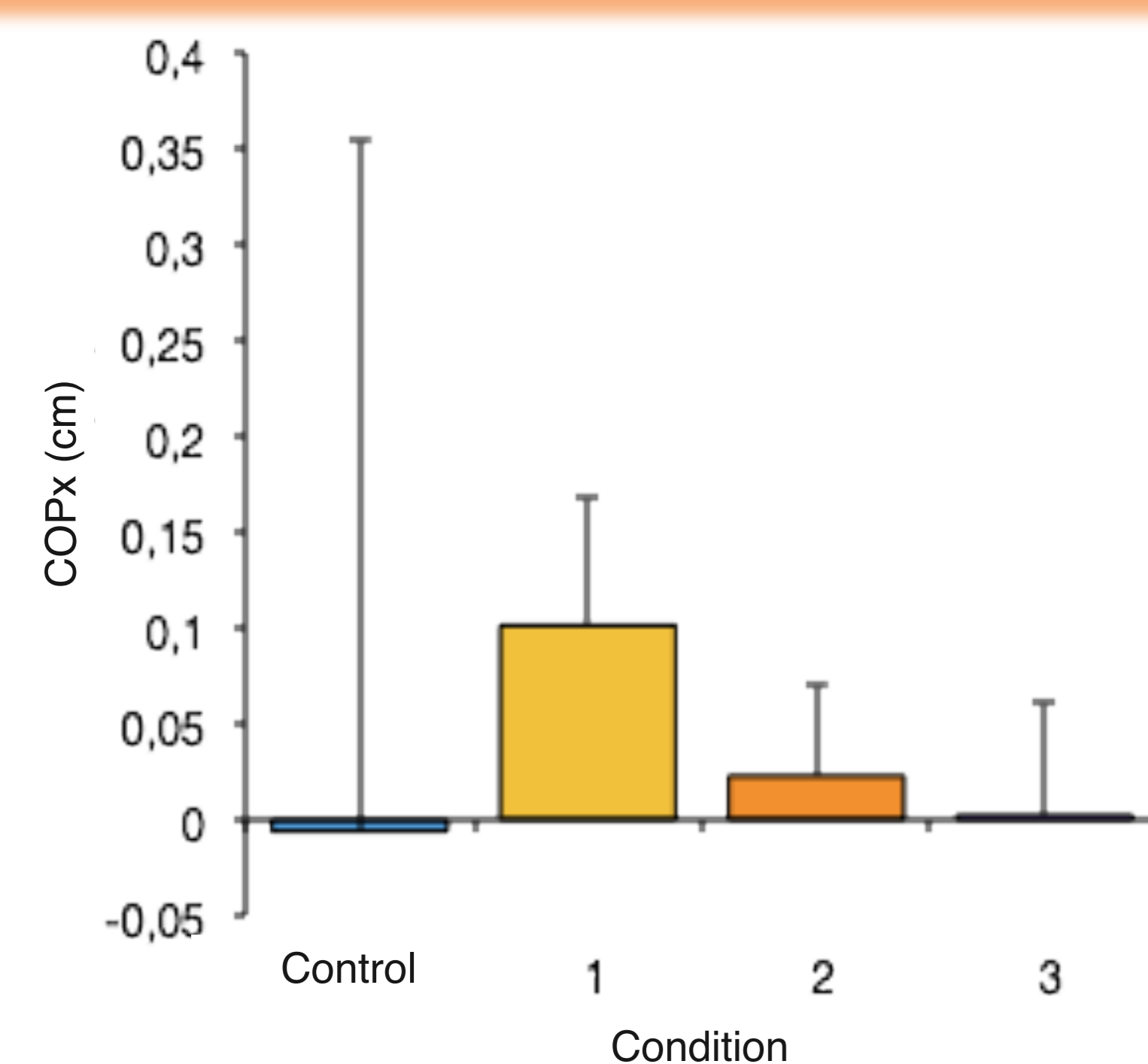


Figure 1. Average movement of COPx.
 $F(3,54) = 1.52; p < 0,2188$

- The results were not significantly different, although conditions 1, 2 and 3 appear to follow the same trend in postural sway as COPy.

Results (continued)

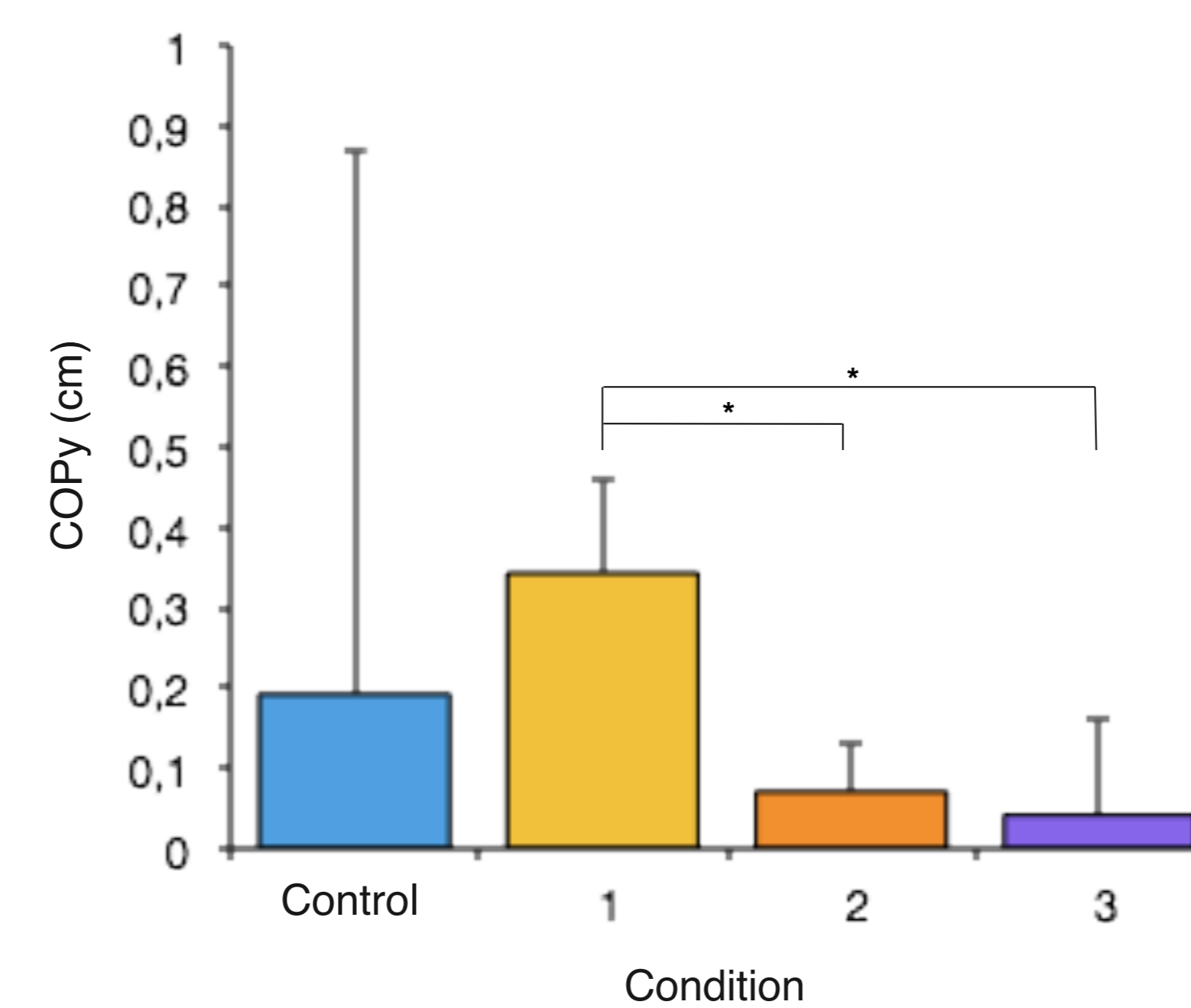


Figure 2. Average movement of COPy. (* $p < 0.01$)
 $F(3,54) = 3.23; p < 0,0294$

- The results showed that the condition 1 was significantly greater than condition 2 and 3.

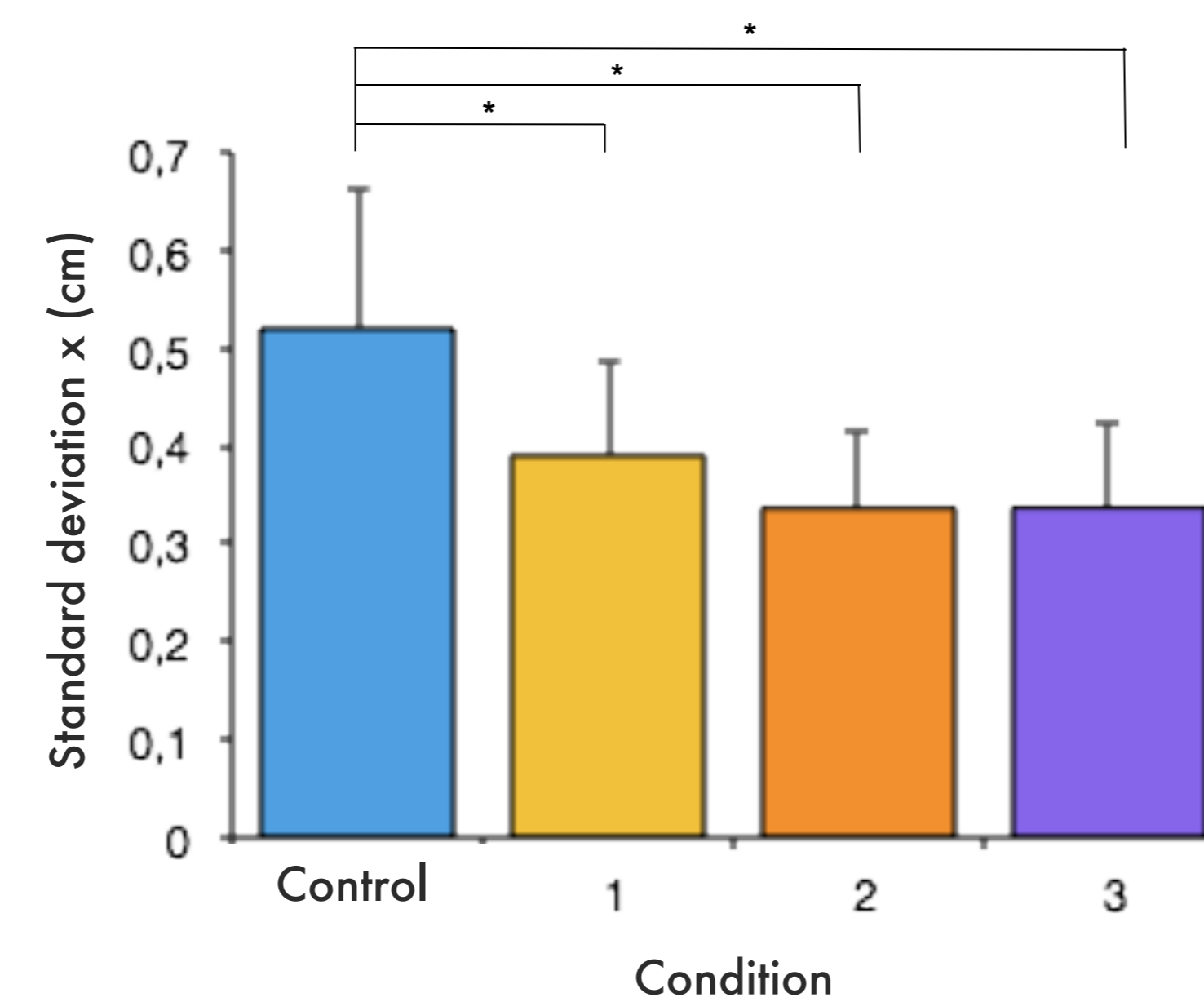


Figure 3. Standard deviation of COPx. (* $p < 0.001$)
 $F(3,54) = 46.14; p < 0,0000$

- The results showed that the control condition was significantly greater than condition 1, 2 and 3.

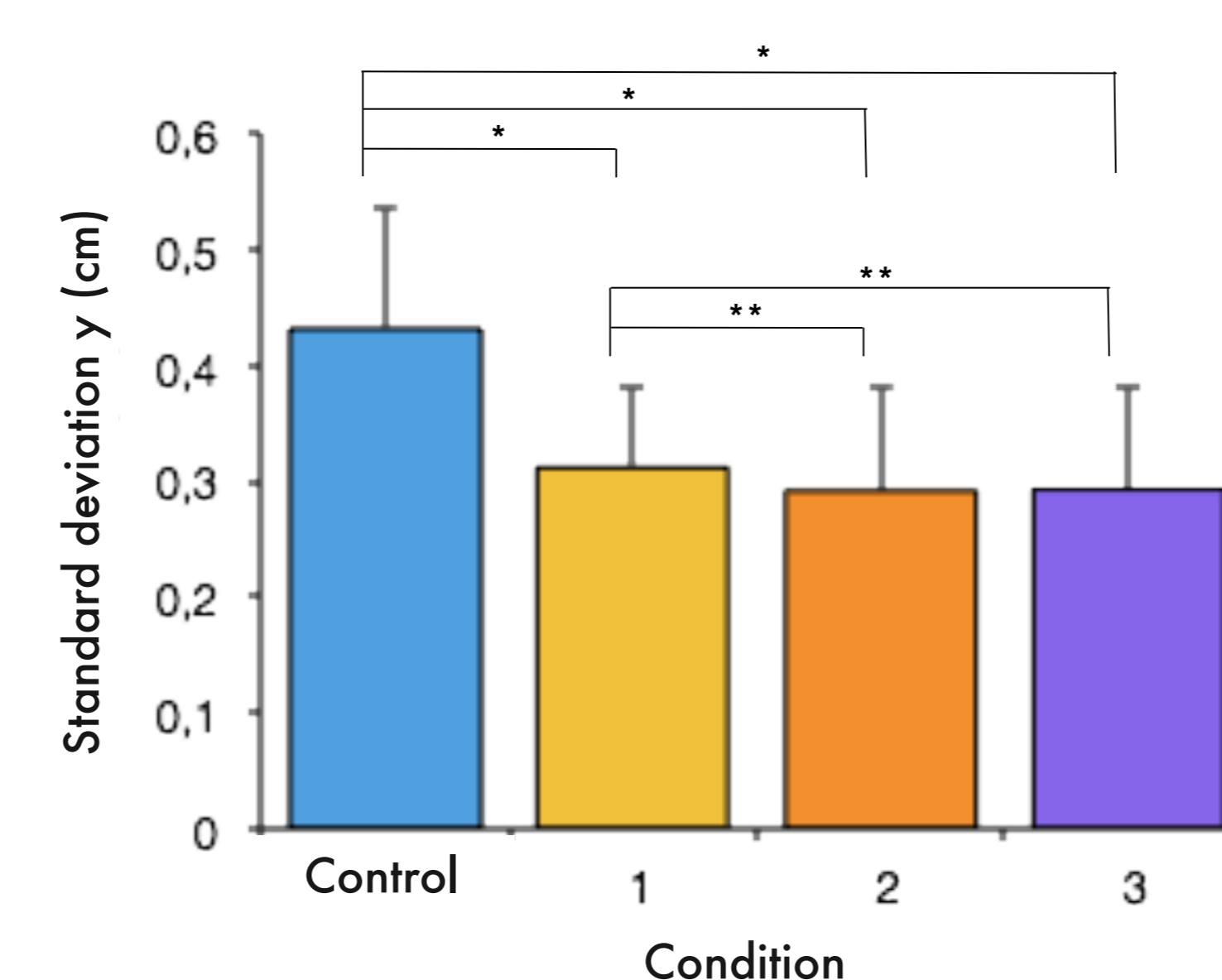


Figure 4. Standard deviation of COPy. (* $p < 0.001$; ** $p < 0.01$)
 $F(3,54) = 33.74; p < 0,000$

- The results revealed that the control condition was significantly greater than condition 1, 2 and 3. Also, condition 1 was significantly different from condition 2 and 3.

Results (continued)

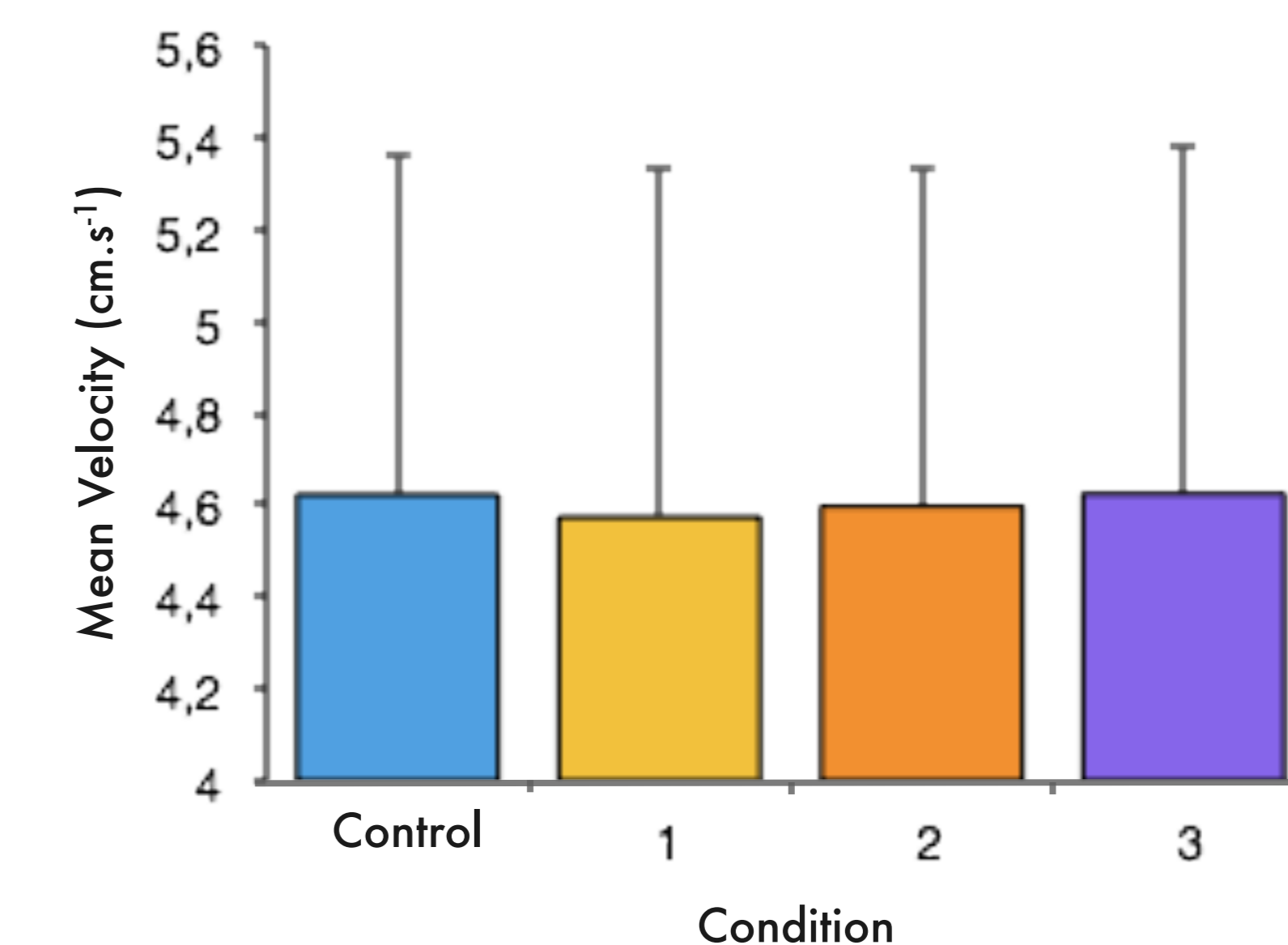


Figure 5. Average velocity of COP.
 $F(3,54) = 1,47; p < 0,2317$

- The results were not significantly different.

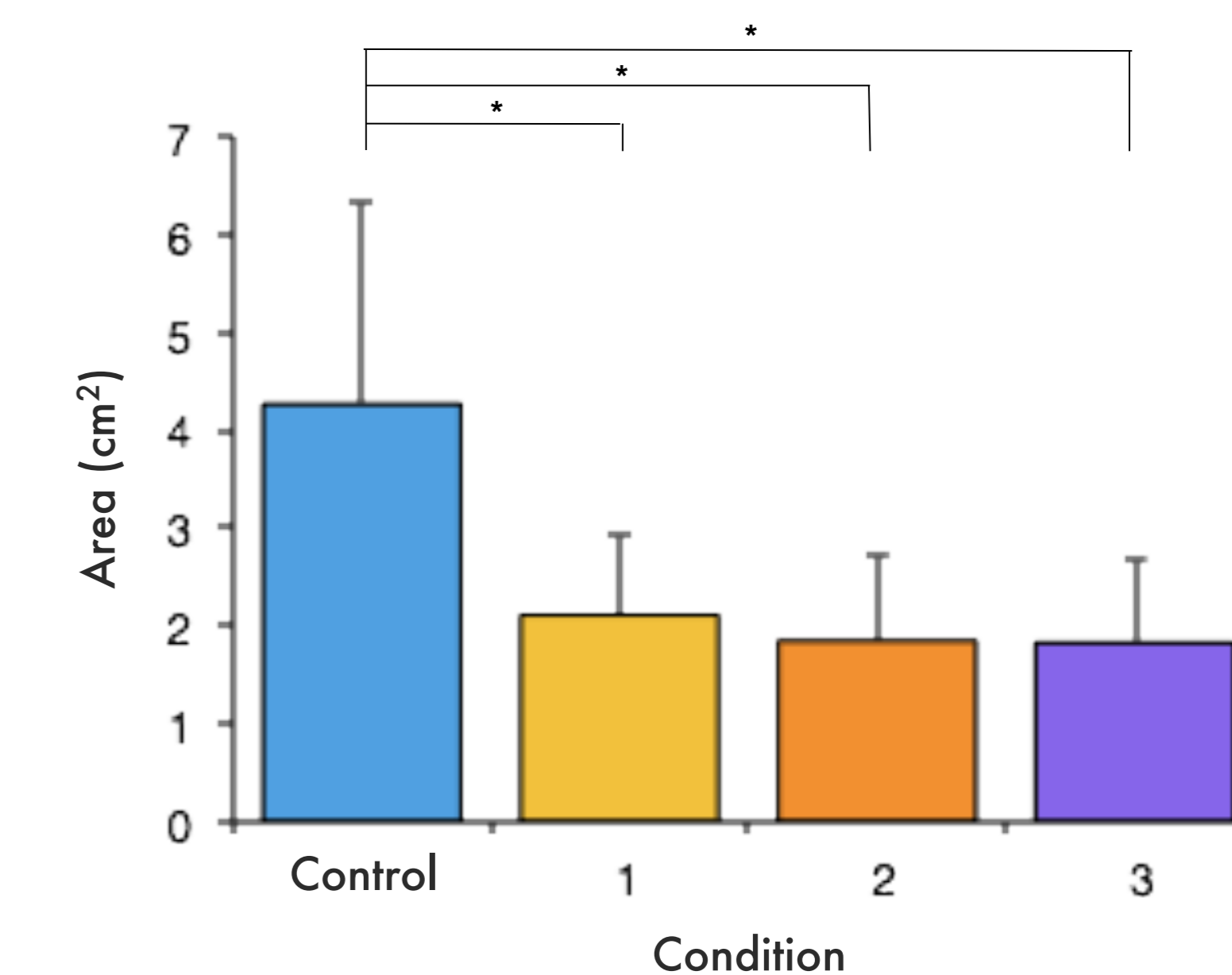


Figure 6. Area covered by COP. (* $p < 0.001$)
 $F(3,54) = 47,35; p < 0,0000$

- The results revealed that the control condition was significantly greater than condition 1, 2 and 3.

Discussion

- As originally hypothesized, biofeedback improved the ability to remain as still as possible, which is in line with previous work (Cawsey et al., 2009).
- The increase of visual biofeedback revealed that: COPy decreased, COP was less variable and COP covered a smaller area. However, there was no significant difference on any of the COP measures between FT x 5 and FT x 10. This suggests that an intensity of 5x the COP is sufficient to improve body sway.
- The regular scale of COP demonstrated that the biofeedback was too small to allow for corrections to posture. But, once the scale on which biofeedback was given increased, it facilitated postural adjustments to maintain a tighter control of balance. This result is also consistent with previous research (Cawsey et al., 2009).
- Future research should explore the maximum intensity that can improve biofeedback in postural sway.

References

- Cawsey, R et al.(2009). To what extent can increasing the magnification of visual feedback of the centre of pressure position change the control of quiet standing balance? *Gait Posture*, 28(2), 280-4.
- Freitas, S. et al.(2012). Joint coordination in young and older adults during quiet stance: effect of visual feedback of the center of pressure. *Gait Posture*, 35(1), 83-7.
- Halická, Z. et al. (2014). Effectiveness of different visual biofeedback signals for human balance improvement. *Gait Posture*, 39(1), 410-4.
- Sayenko, D. et al. (2012). Effects of balance training with visual feedback during mechanically unperturbed standing on postural corrective responses. *Gait Posture*, 35(2), 339-44.