

MUSCLE OXYGENATION IN PATIENTS WITH PERIPHERAL ARTERY DISEASE DURING WALKING WITH AND WITHOUT AN ANKLE FOOT ORTHOSIS

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PURPOSE

- To measure the muscle oxygenation of the calf muscle in patients with peripheral artery disease (PAD) during walking with and without an ankle foot orthosis (AFO).

INTRODUCTION

- PAD is caused by atherosclerotic plaques that limit blood flow to the lower extremities¹.
- Claudication, walking-induced pain in the legs, is the most common manifestation of PAD².
- The times of claudication pain onset and at which claudication pain forces patients to stop walking are known as initial (ICT) and absolute claudication times (ACT), respectively.
- Muscle oxygenation is significantly lower at rest, and it declines faster in the calf muscles of patients with PAD compared to healthy controls³.
- An ankle foot orthosis (AFO) can improve muscle oxygen levels in patients with PAD by absorbing and returning mechanical force, thus decreasing calf muscle demand during walking.

METHODS

- Patients were recruited through the clinic at the Nebraska-Western Iowa Veterans Affairs Medical Center.
- A muscle oxygen monitor (PortaMon, Artinis Medical System) was attached to patient's gastrocnemius.
- Subjects performed the Gardner maximum walk test on a treadmill (0.89 m/s (2.0 mph) that began at 0% grade and increased 2% grade every two minutes).
- Subjects verbally indicated the onset of pain (ICT) and when they were no longer able to walk (ACT).
- The subjects performed the protocol twice, once without AFO (NAF) and once while wearing the AFO (AFO).
- Muscle oxygen saturation, StO₂, was recorded at ICT and ACT for both AFO and NAF trials and compared by a paired-sample t-test ($p < 0.05$).

Table 1. Patients Demographics

n	Age (years)	BMI (kg/m ²)
7	70.75 ± 6.58	32.64 ± 7.45

RESULTS

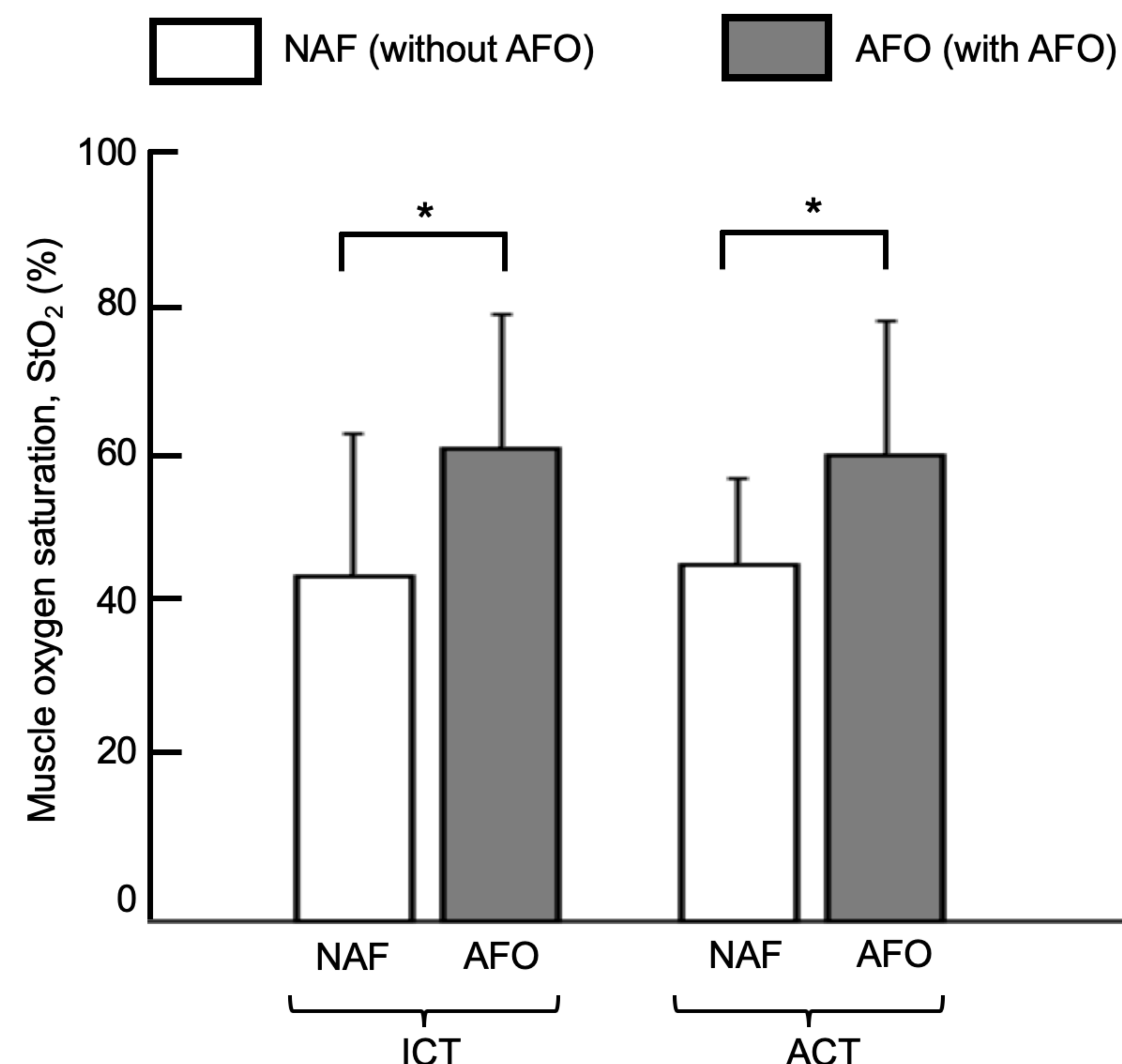


Figure 1: The StO₂ percentage at ICT and ACT for both NAF and AFO trials. * indicates statistically significant difference between NAF and AFO ($p < 0.05$).

- The StO₂ at ICT was 36.97% higher, a significant increase while using the AFO compared to NAF ($p = 0.016$).
- Similarly, at ACT the StO₂ significantly increased 30.19% for AFO trial ($p = 0.029$).
- This suggests using the AFO improves the oxygenated hemoglobin delivery to working muscle during exercise, providing a mechanism for increased walking distances while using the AFO.

CONCLUSION

- Our results demonstrate that using the AFO significantly improved the muscle oxygenation in calf muscle in patients with PAD.
- Future studies should examine how StO₂ impacts physical activity, muscle activity, lower extremity torque and power, and energy cost.

REFERENCES

- [1] Mozaffarian et al. *Circulation* 54, 133-447, 2016. [2] Fowkes et al. *Lancet* 40, 382-1329, 2013. [3] Mesquita RC, et al. *Journal of Biomedical Optics* 18(5), 57007, 2013.

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