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).

RESULTS

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<th>NAF (without AFO)</th>
<th>AFO (with AFO)</th>
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<tr>
<td>ICT StO₂ (%)</td>
<td>60 ± 10</td>
<td>80 ± 10</td>
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<tr>
<td>ACT StO₂ (%)</td>
<td>40 ± 10</td>
<td>60 ± 10</td>
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* indicates statistically significant difference between NAF and AFO (p < 0.05).

Figure 1: The StO₂ percentage at ICT and ACT for both NAF and AFO trials.

• 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.

ACKNOWLEDGEMENTS
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• Ottobock donated some of the AFOs used in the study.

REFERENCES

Table 1. Patients Demographics

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<th>Age (years)</th>
<th>BMI (kg/m²)</th>
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<tr>
<td>7</td>
<td>70.75 ± 6.58</td>
<td>32.64 ± 7.45</td>
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