Effects of Arm Swing During Gait

Travis Young, CPA, MSOP Candidate

California State University- Dominguez Hills Master of Science in Orthotics and Prosthetics Program

INTRODUCTION

Arm swing affects the efficiency (distance/time) with which one ambulates, specifically velocity and balance (Long et al., 2011). Therefore, arm swing efficiency during the gait cycle may allow an able-bodied ambulator to increase velocity and balance. The use of arm swing promotes more efficient walking, while reduction of arm swing will negatively affect the ambulator's walking speed by slowing him/her down and decreasing stability (Punt et al., 2014).

The purpose of this study is to evaluate toe in/out angle and velocity (stride length over time) in able-bodied persons with three different levels of arm swing to determine if arm swing influences ambulation efficiency, which will be defined as velocity (distance/time). It is hypothesized that when decreasing able-bodied arm swing during ambulation that velocity will decrease, while increasing toe in/out angle for a greater balance. Furthermore, that an increase in arm swing will increase the participant's velocity, while decreasing toe in/out angle.

METHOD

Subjects: Twelve healthy young adults, 9 males and 3 females, averaged 25.17 years of age.

Apparatus: The Zeno Walkway

Procedures: Participants walked across the Zeno Walkway, which was 230 and 5/16 long and 27 and 1/2 inches wide, for six passes to collect temporal spatial data. During the first two passes, participants were instructed to walk with restricted arm swing, allowing no movement of the upper extremities. The second set of two passes the participants were instructed to walk as they normally would and for the third set of two passes, the participants were instructed to walk with exaggerated arm swing. Data was collected consecutively for all six passes, respectively.

Data Analysis: Data variables analyzed were: toe in/out angle, stride length, stride time, velocity. Data was analyzed using PKMAS software from ProtoKinetics.

RESULTS

The toe in/out data showed an increase in toe out angle from restricted arm swing to normal arm swing to a then decrease in toe in/out Stride length showed an increase from restricted arm swing, to normal arm swing, to exaggerated arm swing. Stride time showed a gradual decrease in seconds from restricted, to normal, to exaggerated arm swing. Lastly, stride velocity showed an increase in cm/s from restricted, to normal, to exaggerated arm swing.

	Restricted	Normal	Exaggerated
Toe in/out angle	3.65°	3.74°	2.53°
Stride Length	136.7	137.43	162.74
Stride Time	1.129	1.126	1.085
Velocity	122.109	122.585	151.52

DISCUSSION

While this research may suggest that an increase in AS will shorten the stride time, it would need to be further researched with a greater number of participants to see exactly how an increase in AS effects stride time and hopefully data could be collected to reach statistical significance that is outside of the standard deviation. Furthermore, the two previous studies discussed and reported that slower/less arm swing resulted in decreased stability. Long et al. (2011) confirmed their hypothesis that negative alterations in arm swing would slow walking speed, shorten stride length, and that restraint of the arms would result in changes to lower extremity joint moments with greater kinetic changes at more distal articulations, causing instability. However, with the results from this study, nothing can be concluded, but there are results that encourage further and more in depth research.

CONCLUSION

In conclusion, and increase in arm swing could allow for a decreased toe in/out angle and stride time. Moreover, an increase in arm swing could also result in an increase in stride length.

CLINICAL APPLICATIONS

It is suggested with this research that arm swing does effect gait efficiency and we know that persons with amputation and pathology already expend more energy while trying to ambulate and it is important to note that arm swing also effects balance. Therefore, by utilizing arm swing, one can ambulate with more balance and efficiency.

REFERENCES

Long, J. T., Groner, J. B., Eastwood, D. C., Dillingham, T. R., Grover, P., & Harris, G. F. (2011). Implications of Arm Restraint on Lower Extremity Kinetics During Gait. *Journal of Experimental & Clinical Medicine*, *3*(5), 200–206. http://doi.org/10.1016/j.jecm.2011.09.006

Punt, M., Bruijn, S. M., Wittink, H., & van Dieën, J. H. (2015). Effect of arm swing strategy on local dynamic stability of human gait. *Gait & Posture*, *41*(2), 504–509. http://doi.org/10.1016/j.gaitpost.2014.12.002