BIOMECHANIC ANALYSIS OF THE FORCE APPLIED IN AQUATIC GAIT OF HUMANS IMMERSED AT THE STERNUM LEVEL

SOUZA, Patricia Vieira de[1,] HAUPENTHAL, Alessandro[1], SCHUTZ, Gustavo Ricardo[1], & ROESLER, Helio[1,]
1- Santa Catarina State University – UDESC – Brazil – email: patricia@posturall.com.br

INTRODUCTION

The human gait is one of the most studied movements in terrestrial environment [1,2,3], but this fact does not occur in the aquatic environment [4]. Despite of the aquatic environment be a lot utilized for training and rehabilitation, there are few works about the aquatic gait.

This study analyzed the Ground Reaction Force (GRF) vertical component during the aquatic gait. For so much, the objectives of this work were: 1) Verify the maximum value of the GRF vertical component; 2) Compare the GRF inside and outside the water.

METHODS

This diagnostic descriptive study was carried through in the Laboratory of Aquatic Biomechanics Research of UDESC. One invited to participate of this study individuals that possessed stature from 1,60 to 1,85m and no gait disorders. With these criteria, 63 subjects (31 female and 32 male) carried out the experiment. The average ages were 23±5 years old. The average height was 1,70±0,15 m. The water depth was 1,30m. Although that depth of immersion corresponds to a level for each subject, they all had the water reaching their sternum.

In the bottom of a thermal swimming pool (30±1oC) one had put a footbridge of 6,15 m of length containing two underwater force platforms [5] (A and B). One acquired the GRF in the vertical components (Fy) in a rate of sample of 600hz. One has used the acquisition system SAD 32 version 3.0 [6].

Each subject carried out four passages in the footbridge at the maximum speed they could obtain. The average speed was 0,55± 0,05 m/s.

To analyse the reduction in the GRF vertical component in the aquatic gait, their values have been compared to the land gait values. The value used to calculate the force reduction was 1,2N/BW [1,2,3]. For data analysis one utilized descriptive statistics through the program Microsoft Excel.

RESULTS AND DISCUSSION

In the vertical component the forces had varied 59% of the subjects' corporal weights., as one can see in Table 1 .

Table 1: Maximum Force in Fy e Fx (N/BW) and reduction compared to land gait values (%).

	FyA	FyB
(N/BW)	**0,59**±0,09	**0,58**±0,08
(%)	**51**±8	**52**±7

For a better understanding of the alteration that occurs in the underwater gait, a force×time curve for GRF vertical component at the sternum level is compared to a GRF curve outside the water. One can visualize that occurs a curve rectification, the peaks are next to deflection and the load absorption happens in a larger time until the first force peak (Figure 1). The "M" look curve common in the outside water gait [2.3] is not characterized inside the water and the curve morphology is similar to a trapezium.

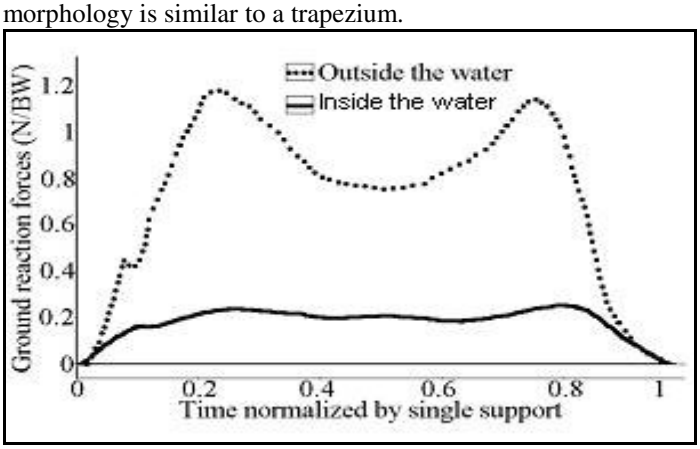

Figure 1: Comparing the force×time curves for GRF vertical component outside the water and aquatic gait.

The found values in this study for maximum force in the GRF vertical component are inferior to the ones previously reported by Harrison et al [7]. The BW reduction values are similar to the ones found by Brito [8], in wich study the immersion level was at the hip and the speed was smaller.

CONCLUSIONS

One can conclude that at the sternum immersion level the GRF vertical component can be altered in significant values. The curve shape is similar to a trapezium, differently from the land curve.

This work values point out that submmiting the individual to an exercise inside the water at this immersion level can bring benefits when it comes to reducing the resultant load. Knowing these values and their relations to other immersion levels is crucial to activities prescription in aquatic environment.

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