

LYPHHEDEMA TREATMENT'S EFFECT OF GAIT PARAMETERS

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1. Introduction

Lymphedema is the swelling caused by the accumulations of lymph, which may occur if the lymphatic system is damaged. As a result of the damaged functioning some protein rich fluid escape the body's tissue (Fig. 1.). It can affect any part of the body, but usually develops in the limbs and the fingers. The disease affects the locomotion system, therefore it can be assumed that it decreases the effectiveness of the gait parameters and causes malfunction. [1]



Fig. 1. A lymphedemic foot in Stage 3.

Unfortunately, there is no any conventional practice to observe the effectiveness of the lymphoedema management. Therefore, the aim of this research is to construct a well defined process offering an opportunity to have this ability.

2. Methods

The purpose of this paper is to analyze how the specialized treatment, which was developed in the National Institute of Medical Rehabilitation, changes the overall picture of gait. The 23 examined patients were in different phases of the condition (stage 1., 2. and 3.). Before and after the therapy a pilot study was executed in order to observe the gait parameters. The measurement was performed on an instrumented treadmill with

optional velocity. Applying the data of the treadmill equipped with pressure-measuring sensors, we were able to calculate the force awaking in the forefoot, the midfoot and the heel on both legs, furthermore, the butterfly parameters and gait parameters such as stance phase, swing phase, load response ect., which are illustrated in Fig. 2. During the experimentation the simplified kinematical parameters (e.g. geometry and timing parameters) were defined by the Zebris processing program. The geometry parameters are presented in Fig. 3.

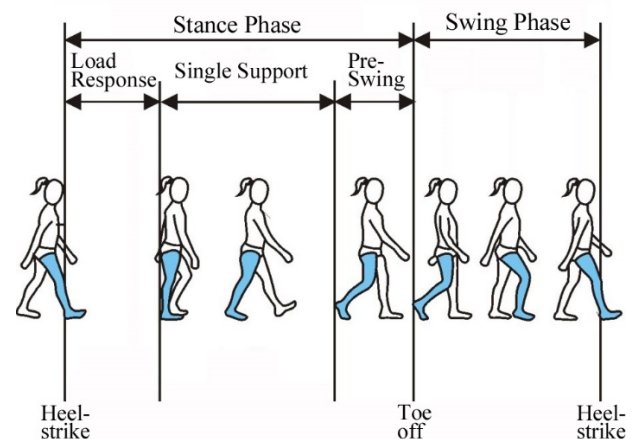


Fig. 2. Basic gait parameters during one stride. [2]

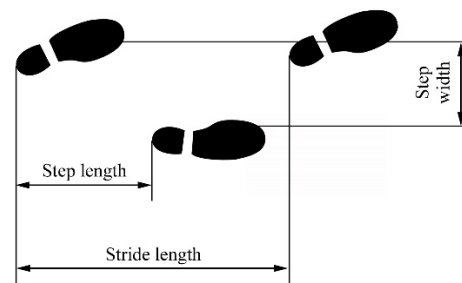


Fig. 3. Geometry parameters during one stride.

One-sample t-tests were performed to define the treatment's effectiveness. Moreover, independent two-sample t-tests were applied to compare the different phases of the condition.

There were some patients with one side injured leg, in this case the differences between the healthy and the damaged side were examined using one-sample t-tests. The determining factor was 0.05 in both cases.

3. Results

The results could be detached in two ways. Firstly, the average gave information about the overall picture of gait. On the other hand, using the coefficient of variation (CV) calculated by the average and deviation data the regularity of the gait could be estimated.

Observing the both side injured patients apart from the phases of conditions the therapy primarily influenced the kinematical parameters (Tab. 1.). Taking into consideration the seriousness of the disease, the results showed that the various treatments did not affect in the same way. In Stage 1. the regularity of the gait was mending while in case of patients with more serious (Stage 2. and 3.) lymphedema the kinetical parameters were changed significantly especially the average values. Some of these changes are summarized in Tab. 2.

	step length	stride length	cadence	length of gait line
average	0.0373	-	-	0.0209
CV [%]	-	0.0291	0.0365	0.0226

Tab. 1. Significant differences when the treatment's effectiveness were observed.

Significant differences in Stage 1.

	foot rotation	swing phase
average	-	-
CV [%]	0.0352	0.0455

Significant differences in Stage 2. and 3.

	force backfoot (left leg)	force backfoot (right leg)	length of gait line
average	0.0157	0.0027	0.0241
CV [%]	-	-	-

Tab. 2. Significant differences when the treatment's effectiveness were observed in variant stages.

Compared to the healthy and damaged side in case of one side injured patients it could be assumed that both the regularity and the overall picture of gait were mending on the intact side. Probably, the corrective-gymnastic part of the

therapy was enough to develop the healthy leg, but not enough to improve the diseased.

Finally, comparing the different phase of the condition the progress of the lymphedema could be traceable. Several differences are showed in Tab. 3. In sum, the seriousness of the disease affected the butterfly parameters as a result in stance phase the weight transmission changed significantly. This accomplishment is in accordance with the result of the obese patients' gait analysis. [3]

<i>Before the therapy:</i>			
	step length	single support line	length of gait line
average	-	0.0190	-
CV [%]	0.0435	-	0.0343
<i>After the therapy:</i>			
	load response	ant/pos position	length of gait line
average	0.0335	-	-
CV [%]	-	0.0096	0.0393

Tab. 3. Significant differences comparing the phase of condition.

4. Conclusions

In this paper we declare that the seriousness of the lymphedema significantly influences the kinematical and kinetical gait parameters. As a result of the treatment some improvement were observed. In conclusion, our results provide that the disease modifies the gait parameters, and the effectiveness of lymphedema management is exceedingly traceable with a pilot study.

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