


Evaluation of rehabilitation influence on flat foot in children by plantar pressure analysis

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ABSTRACT

Vorlickova, L. & Korvas, P. (2014). Evaluation of rehabilitation influence on flat foot in children by plantar pressure analysis. *J. Hum. Sport Exerc.*, 9(Proc1), pp.S526-S532. The flatfoot diagnosis in childhood belongs to the most frequent diagnosis in the orthopaedic and physiotherapist clinics. The aim of this research is to evaluate the influence of rehabilitation on the values of plantar pressures. Emed platform was used for measurement. The research group consisted of three subjects (aged 6.3 ± 1.7 years) with the flat foot diagnosis. Statistical analysis of mean pressures found the increasing of these pressures in the middle foot region after rehabilitation. Similarly, significantly decreasing of contact area were found in the region of the middle foot. The method of plantar pressure analysis can help improve a foot function and evaluate the treatment effect. This study indicates the effect of rehabilitation on foot arch in childhood. **Key words:** FOOT ARCH, PLANTAR PRESSURE, EMED, REHABILITATION OF FLAT FOOT.



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8th INSHS International Christmas Sport Scientific Conference, 5-7 December 2013. International Network of Sport and Health Science. Szombathely, Hungary.

JOURNAL OF HUMAN SPORT & EXERCISE ISSN 1988-5202

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doi:10.14198/jhse.2014.9.Proc1.42

INTRODUCTION

The flatfoot diagnosis in childhood is a widespread diagnosis in the orthopedic and physiotherapist clinics. Current treatment of this deformity consists of wearing good shoes, stimulation of soles in daily life, wearing orthopedic inserts and rehabilitation therapy. Authors agree with wearing good shoes and with stimulation of soles in daily life. But different views are on orthopedic inserts and rehabilitation treatment. The aim of this research is to evaluate the influence of rehabilitation on the values of plantar mean pressures and contact area in flatfoot diagnosis.

MATERIAL AND METHODS

Participants

The research group consisted of three participants with the flat foot diagnosis. It is a flexible flat foot, when the arch is reduced in loading, and without load is the arch increasing. The average age was 6.3 ± 1.7 years, the average weight was 21.0 ± 3.6 kg. Children, boys, were voluntary participant from Brno and near neighbourhood. Written informed consent was obtained from all parents of participants prior to data collection.

Procedures

There was used Emed platform for static measurements of plantar pressures distribution and for monitoring of foot contact area. The measurement was performed before rehabilitation exercises. The measurement was performed three times for each foot in standing positions and took twenty seconds. Then started the rehabilitation therapy and was doing 45 minutes, twice a week, a total number of therapy was 10. The Propriofoot concept was used as a rehabilitation tool. The developers of Propriofoot concept are Paris and Baicry, French physiotherapists. The Propriofoot concept has 19 exercises, which are combination of four special balance plates (figure 1). The main advantages of this balance plates are: segmental sensomotoric activation of feet, activation of the leg muscles and stabilization of foot arch. The same measurement with Emed platform was performed after rehabilitation therapy. Between first and second measurements was five week.



Figure 1. Rehabilitation of foot with Propriofoot concept

Analysis

After measurements, the sole was divided with the software Multimask evaluation into five areas for the analysis of mean pressures and contact areas. The areas were: heel (M01), midfoot (M02), forefoot (M03), thumbs (M04) and 2nd, 3rd, 4th, 5th toes (M05) (see figure 2). Especially, we interested in the region of midfoot. This area of midfoot was chosen for evaluation of changes of the foot arch height. The results of mean pressures and contact areas were taken from the average values from three measurements of each

sole. The statistical method included only a comparison of average and standart deviation of mean pressures and contact areas, because of small group.

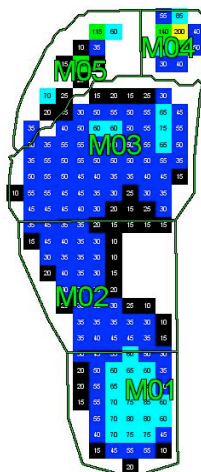


Figure 2. Dividing of foot into five areas

Legend: M01 – heel; M02 – midfoot; M03 – forefoot; M04 – thumbs; M05 – toes

RESULTS

For example, you can see the pressures distribution of the feet of first participant before and after rehabilitation therapy in figure 3 and 4. The mean pressures of midfoot from all participants are shown in table 1. The analysis of mean pressures found the increasing of these pressures in all three participants. This is shown at the graph for left foot (see figure 5) and right foot (figure 6).

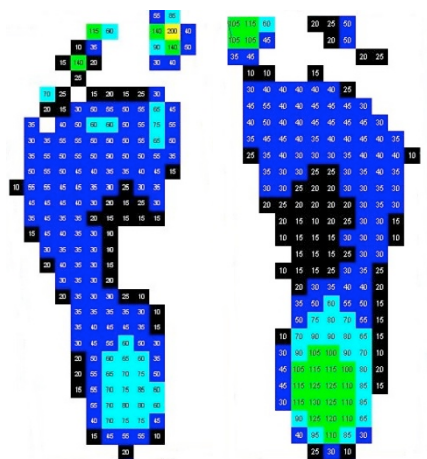


Figure 3. Example od plantar pressures distribution before rehabilitation therapy in first participant

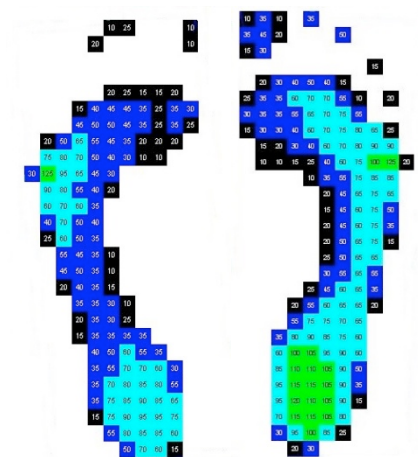


Figure 4. Example of plantar pressures distribution after rehabilitation therapy in first participant

The values of contact area for all participants in midfoot are shown in table 2. Similarly, the decreasing of contact area was found in midfoot in all three causes, as you can see at the graph for left and right foot (figure 7 and 8). In the first case was the difference 3.7 cm² on the left and 3.5 cm² on the right foot. The second participants had the difference 1.7 cm² on left and 2.5 cm² on right foot. The last child had the difference 5 cm² on left and 5.2 cm² on right foot.

Table 1. The values of plantar mean pressures before and after rehabilitation

Participant	Therapy	Mean pressures [kPa]	
		Left	Right
First	Before	27.5 ± 1.6	31.1 ± 0.1
	After	35.9 ± 2.1	49.9 ± 3.1
Second	Before	23.2 ± 6.2	26.9 ± 0.6
	After	36.6 ± 3.1	48.4 ± 7.4
Third	Before	18.4 ± 2.7	25.4 ± 3.0
	After	37.0 ± 2.1	35.3 ± 5.4

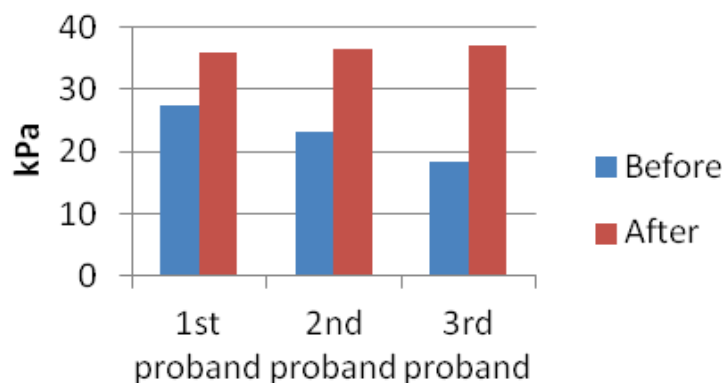


Figure 5. Graph of mean pressures on left foot before and after therapy

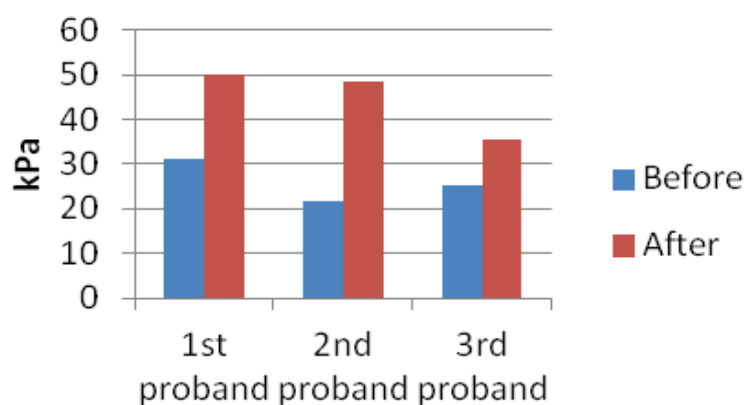


Figure 6. Graph of mean pressures on right foot before and after therapy

Table 2. The values of contact area before and after rehabilitation

Participant	Therapy	Contact area [cm ²]	
		Left	Right
First	Before	21.0 ± 3.5	22.8 ± 6.7
	After	17.3 ± 1.8	19.3 ± 0.4
Second	Before	19.0 ± 2.1	23.0 ± 1.6
	After	17.3 ± 3.4	20.5 ± 2.8
Third	Before	13.8 ± 0.4	15.0 ± 2.1
	After	8.8 ± 0.4	9.8 ± 0.4

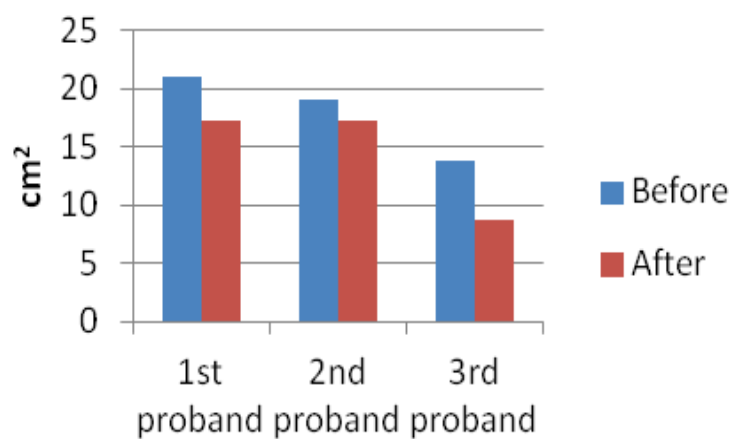


Figure 7. Graph of contact area on left foot before and after therapy

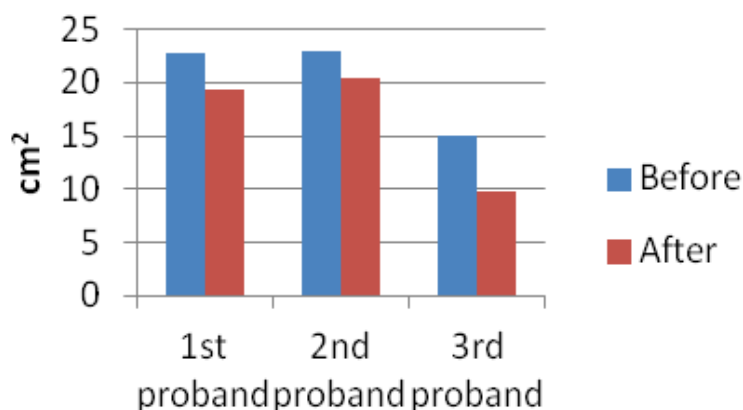


Figure 8. Graph of contact area on right foot before and after therapy

DISCUSSION

The prevalence of flat foot diagnosis is 44 % in childhood (Pfeiffer et al., 2006). Authors have a different views are on rehabilitation treatment of flat foot diagnosis (Evans, 2008). For example Rose (2007) is for flat foot treatment, on the other hand Adamec (2005) describes in his article, that rehabilitation has no treatment effect. The aim of this research is to evaluate the influence of rehabilitation on the values of plantar pressures and contact area in midfoot used Emed platform for measurement.

The evaluation of plantar pressures distribution of feet is commonly used in assessing of foot orthopedic defects, which includes flat feet too. These data provide us with the view of plantar loading during functional activities such as standing. The data can be used for assessment and evaluation of the feet before and after therapeutic intervention, in this study rehabilitation therapy. Plantar pressure measurement can be a useful way to clinically track static foot function in children (Oladeji et al., 2008).

This research describes the results of three case – three children with flat foot diagnosis (aged 6.3 ± 1.7 years). Measurements were performed before and after rehabilitation therapy. The sole was divided into five areas with the software Multimask evaluation. We interested in the area of midfoot for evaluation of changes of the foot arch. There were evaluated the plantar pressures distribution and contact area before and after rehabilitation therapy. The analysis of mean pressures found the increasing of these pressures and decreasing of contact area in midfoot in all participants. Especially, the decreasing of contact area in midfoot indicates the increasing of foot arch heigh. This could be caused by activation of muscles that stabilize foot arch.

CONCLUSIONS

The Propriofoot concept is a rehabilitative approach to activate the foot arch. This method is using four special balance plates in standing on one leg position. We used Emed platform system for plantar pressure and contact area measurement. This three cause study confirms the increasing of mean pressures and decreasing of contact area in midfoot in all participants. This study indicates the effect of rehabilitation on foot arch in childhood, but for more accurate results the research group will be extended.

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