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# The Effects of Elementary School Students' Feet Deformity Removal Program

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**Summary**
Children in their motional activities have more and more contents of static nature, or even contents od dynamical nature that are not of sufficient quality to cause the appropriate transformation of the anthropological status. Because of a lifestyle like that, feet deformities occur, and they can cause pain in the lower extremities, disrupt the normal structure in relations of the lower extremities (X or O legs) and even cut back the child's desire for further excercising of motional/sports activities. The goal of this research is to determine the effects of deformity removal program on samples of boys and girls at the age of 10 and 11. The analysis of determining the deformities was performed by Mayer's method for valuation of feet posture at a total sample of 85 examinees, and the statistical verification of the reaction to the program was performed with the use of T – test for the dependent samples. The results obtained during the research have shown that the corresponding program may affect the reduction or removal of the analysed deformity. The program applied to this research can be recommended for further work and use on populations similar or identical anthropological features.

Key words: **Hypokinesia, Programmed excercise, Transformation processes**

## Introduction

The trend of reduced movement of children is causing the increase of obesity in children's and adolescent age, resulting in overweight and occurence of different disorders in body posture (Yosinaga et al., 2002). One of the disorders that also appears as a result of reduced movement of children is feet deformity (Cousins et al., 2013). Child's foot is made of many muscles, tendons, neurovascular elements, ligaments and 26 and 32 articular surfaces (Mauch, 2007). The functions of feet are the function of passive-static load by standing and the active elastic-dynamic function by moving in space (Mađarević and Mustafičić, 2010). These two seemingly opposite functions (stability and elasticity) are achieved thanks to vaulting that are determined according to the points that are most exposed to the pressure. Those are: heel, the head of the first and the fifth metatarsus. When the points between these bones are connected, three vaults are obtained: longitudinal inner vault, longitudinal outer vault and transverse vault. The height of the longitudinal vaults is determined by the bone shape, the muscle strength and the resistance of the ligaments (Morrison et al., 2007). A baby is born with flat feet, and the feet vaults are not formed until the baby's first steps (Hadžikadunić and Balta, 2000; Hadžikadunić and Mađarević, 2004). The feet vaults should be fully formed until the age of three. A well developed feet vault is characterised by: pear-shaped form of the heel, the front part of the feet connected to the heel with a narrow connector, noticeable angle at the transition from the connector to the front part of the feet and clear prints of all five fingers. Deformities in the structure or the shape of one foot bone are causing disorder in the function of the foot. These malformations are progressively increasing during the growth and cause secondary changes (Antropova and Koljcova, 1986) on the contiguous and distant segments (knee, hip, spine). The circle of the occurrence of feet deformity starts with the change of shape and position of the feet, because of the load oftenly cause by walking, and so the feet shape changes functionally, aesthetically and structurally (Kovač and Smajlović, 2006; Jovičić, 2007). Functionally disturbed feet that do not carry any load, have a regular shape and all the vaults can clearly be seen. Only in the support the lowering of the vaults occurs. In this research the feet deformity is determined by taking the plantogram – a barefoot footprint, after which there has been an evaluation of the deviation of foot posture, done with Mayer's method. After determining the deformity, a program for reducing on removing it has been used, which showed the effects of the conducted excercise program, which was the goal of this research.

## Methods

### Examinee sample

The analysis of children's feet posture is conducted on a sample of (n=40) boys and (n=45) girls at the age of 10 and 11. All the examinees have approached the same footprint measurement – plantogram. The parents have been introduced to the purpose and the method of the testing and they have aggreed to the realisation of this research.

### Sample of variables

The variable used for determining the feet deformity was obtained measuring the deviation of the middle part of the foot from the drawn Mayer's line (Cvjetičanin, 1993, pg.23). The result is registered in milimeters (mm). The measuring is done before (initially) and after (finally) the conducted excercise program.

### The decription of the measuring technique

One of the method for feet deformity diagnosis is taking colour footprints and transferring it to the paper. In that way, the shape of the foot is coppied at full support and we get a two-dimensional print (the examinees step with their dominant foot on a provided paint-soaked pad and they performe the appropriate pressure, and they do the same thing on a blank paper). Based on the print, the degree of the lowered foot is being determined. Mayer's method for determining the feet deformity is used to determine the deformity (Cvjetičanin, 1993, pg.23). The valuation is done as follows: the measurer draws a line from the middle of the heel print to the medial edge of the forth toe (AB line) and then the measuring of the deviation of the foot vault is done which is recorded in milimeters (Picture 1). In case that the width of the middle narrow part of the footprint exceedes Mayer's line on the medial side, the examinee has a lowered foot. If the part of the foot is set before Mayer's line, then we have a enlarged foot vault. Because of the simplicity and possibility of discovering the deformation in the early phase, this method is most easily acceptable for routine determining of lowered feet (Trošt et al., 2005). The results of the measurement are necessarily told to the examinee.

*Picture 1. Schematic overview of the evaluation – Mayer's method*


### A program for removing or reducing feet deformity

Excercises for removing or reducing feet deformity were applied every day, in a period of one hundred (100) days. Excercises were divided into two periods of day: forenoon, when first to seventh excercise are applied for a period of three minutes each (21 minutes in total) and afternoon when eight to fourteenth excercise are applied for a period of three minutes each (21 minutes in total). Therefore, total daily excercising lasted for forty-two (42) minutes. To avoid the monotony of the excercising, different excercises before noon and after noon are deliberately applied (Nemec and Nemec, 2009; Malešević and Milijević, 1983). Considering that only strong enough and regularly performed excercises can give satisfactory results (Karaiković, 1986) and in order to avoid the formal approach to the realization of excercises, children and their parents are introduced to the regular way of performing the excercises (Findak and Stella, 1985). To parents who previously approved conducting the excercise program, the importance of the supervision that they have to conduct during the realization of excercising was specifically emphasized. All the students, no matter their degree of deformity, were provided with the same excercise program (Table 1).

*Table 1. The excercise program for removing or reducing feet deformity*

| | EXCERCISE DESCRIPTION | DURATION | APPOINTMENT |
|---|---|---|---|
| 1. | The excercise begins with the flexion of the toes, and then fan-shaped expansion. Toes are intermittently expanded and shrunken. | 3 min | 07:15 to 07:36 |
| 2. | A rope that has 1 cm diameter and is 1 m long is placed on the ground. Toes are lifted and expanded ansd the rope is reached that then goes under the feet. This motion is repeated until the whole rope is pulled over. It is excercised with both legs at the same time. | 3 min | 07:15 to 07:36 |
| 3. | The excerciser walks on the front part of his feet, while his heels are lifted above ground. | 3 min | 07:15 to 07:36 |

| | | | |
|---|---|---|---|
| 4. | The excerciser bends his toes and feet (convulses them) and he moves back and forth that way. | 3 min | 07:15 to 07:36 |
| 5. | Sitting on the ground, resting hands behind the back and legs bended in the knee. Feet are on the ground. We lift one leg and intermittently touch the knee of the other bended leg first with toes and then heel. | 3 min | 07:15 to 07:36 |
| 6. | The excerciser grabs the rope of 1 cm diameter and 1 m long using the toes of one foot and lifts it up. While holding it up, he tries to take the rope with the toes of his other foot. | 3 min | 07:15 to 07:36 |
| 7. | A paper tissue is fixated with one foot, while it is being ripped in many small pieces by the other foot. | 3 min | 07:15 to 07:36 |
| 8. | We grab a pencil with each of our feet and act like we are knitting. | 3 min | 16:00 to 16:21 |
| 9. | We scatter popcorns, marbles, small toys around the ground. They are lifted from the ground with toes. Right leg to the left arm and conversely. | 3 min | 16:00 to 16:21 |
| 10. | While standing, intermittently, we place foot by foot on a tennis ball, we transfer the weight of our body on the ball, rubb it on the ground, squeeze it and roll it. First one foot, and than the other. | 3 min | 16:00 to 16:21 |
| | While holding small toys with his toes, the excerciser walks on his heels. It is important that the toys don't fall on the ground. | 3 min | 16:00 do 16:21 |
| 12. | The pencil is placed between the big toe and the toe next to it. We fixate the paper with the other leg. The task is to draw an optional object. | 3 min | 16:00 to 16:21 |
| 13. | On the ground we place a rope of 1 cm diameter and 1 m long. The excerciser walk on it on the front part of his foot. | 3 min | 16:00 to 16:21 |
| 14. | Place a hoop on the ground (standard shape and size). While walking on it, the excerciser is balancing like he is walking on a rope. | 3 min | 16:00 to 16:21 |

### Data processing methods

For determining the effects of program for removing children's feet deformity, T – test was used for dependent samples on a level of statis significance on a level of $p \leq ,05$. The results were processed in a program package IBM SPSS 22 for Windows.

## Results

The results of T-test for dependent samples – boys (Table 2), that was realized as an extracurricular activity, have shown positive effects of the conducted program in a duration of 100 days. The results clearly show that the deviation from Mayer's line in the final measurement had decreased by 2 mm, which shows statistically significant changes on the level $p \leq 0{,}001$.

*Table 2. T test for dependent samples, Boys/Boys before and after programs*

| | Mean | S. D | S.E.D | t | df | Sig. |
|---|---|---|---|---|---|---|
| **Initial measuring** | ,06 | 0,53 | ,004 | 3,50 | 36 | ,00 |
| **Final measuring** | ,04 | ,029 | ,004 | 3,50 | 36 | |

*Mean - average value, SD - standard deviation, SED - Std. Error Difference, t-Degrees of liberty, df – Difference, Sig- Significance of differences between the groups*

The results of the T-test for dependent samples – girls (Table 3) have also shown positive effects of the conducted program. The duration of the proram realization is 100 days and it was realized as an extracurricular activity. It is noticeable that the deviation from Mayer's line in the final

measuring has decreased in 3 mm, which shows the statistically signicifant changes in feet posture, on a statical level of $p \leq 0{,}001$.

*Table 3. T – test for the dependent samples Girls/Girls before and after programs*

| | Mean | S. D | S.E.D | t | df | Sig. |
|---|---|---|---|---|---|---|
| **Initial measuring** | ,05 | ,047 | ,004 | 2,90 | 32 | ,00 |
| **Final measuring** | ,02 | ,023 | ,004 | 2,90 | 32 | |

*Mean - average value, SD - standard deviation, SED - Std. Error Difference, t-Degrees of liberty, df – Difference, Sig- Significance of differences between the groups*

## Discussion

The defined goal of this research by which the effect of feet deformity removal program was supposed to determine is confirmed. Before the excercising it is found that feet deformity is present with boys so that, out of 40 examinees, 37 of them have a deformity, while in the population of girls, out of 45 examinees, 33 of them have a registered disorder in feet posture. These feet deformity relations, related to gender and age, are also defined in a research conducted by Bokan and Borković (2006) and also in a research conducted by Mihajlović et al. (2008) where it was found that a slightly higher number of male examinees have a conspicuous disorder in feet posture. After determining that both populations have changes on their feet, the practice of feet deformity removal program has been approached. Both with boys and girls, no matterwhat degree of deformity they were specified, same activities have been used. After the realization of the progeam, which was supported by their parents in a way that they have given a written consent that they will and have actively supervised everyday excercising, and after the expiration of the 100 days period, we approached re-taking the footprints. Statistical indicators have confirmed that there has been a decrease both the magnitude and the number of deformities, which is in accordance with the results of a research by Kendović et al. (2007) which also confirmed that the number of deformities is decreasing with the passing of excercise time and children's growth. In the conducted research, the effects of the program are successful for both populations. The program is applyable also for a sample that Medojević and Jakšić (2007) treated in their research, by which the differences between the number and the kind of deformities with male and female population were established, and where it had to be reacted in a right way of removing or reducing them. Reducing or removing feet deformity, which occurs as a result of this program will positively affect also the development of children's motor skills because De Toia et al. (2009) have found that there is a connection between violated anthropometry and motor skills of preschool children population. Positive effect was created with the applied program equally with boys and girls, and the same one can be used to remove or reduce feet deformity with both genders, which is similar to the conclusions in the research by Mihajlović et al. (2010). Pfeiffer et al. (2006) have concluded in their research that the program for reducing and removing feet deformity can be preventively used, therefore in this research too the conducted program can be recommended for preventive action.

## Conclusion

There is a continuated need to educate parents, but also the teachers, in the field of noticing and recognizing body deformities. If both of them notice their presence on time (while they are in the phase of funktional disorder) the posibility of rehabilitation is bigger and the entire procedure is more efficiant. It is good if the deformity is noticed during the teaching process, and the teacher recommends a program that would bi realized during the curricular or extracurricular activities. It is also possible that the parent is the first one to notice the deformity and signalized it to the teacher in time. Then a certain program can be made, that is, like in this research, realized under the control of the parents in the form of an extracurricular activity. In both cases, the principal of unified action is fulfilled, which besides the preventive nature also has an effect of increasing the whole motional activity of the children.

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