Characteristics of the medial longitudinal arch of foot in primary schoolchild footballers

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Abstract

We examined the effect of age on structural changes of the foot in primary schoolchild footballers. Also, we considered whether medial longitudinal arch of foot (MLA) changed due to a foot part disorder. Subjects were classified into a normal group and a foot disorder group. Arch sedimentation rate was used for an index of MLA. The arch sedimentation rate showed a gradual decrease with age in the normal group. On the other hand, the arch sedimentation rate of the foot part disorder group was greater than in the normal group. In conclusion, it was suggested that a support function of MLA being built by a growth process and the rupture of the support function were associated with foot part disorders.

Keywords: static index, arch ratio, dynamic index, arch drop ratio, primary schoolchild footballer, ankle/foot pain,

Introduction

Sports-related disorders in the period of growth include many disorders of the bone cartilaginous septum, and there are many disorders of the knee and the lower limbs such as foot parts about the involved site [1]. It has been reported that motor period examination is useful in the early detection of disorders [2]. An orthopedic medical check for the purpose of early detection of sports dyskinesia was conducted in primary schoolchild footballers in Tokushima 20 years ago. We added an evaluation of MLA as a check item. We conduct an investigation into foot part disorders and the relationship that are in a foot part form. In this study, the changes in foot parts, including MLA form were examined in primary schoolchild footballers. Furthermore, the relationship to the foot part disorder was examined.

Materials and Methods

The subjects were 1,065 (8-12 years old) primary schoolchildren who received primary schoolchild soccer a medical examination of Tokushima from 2009 through 2011. Subjects were classified into a group (foot part disorder group; n=281) which experienced foot pain, and a group (a normal group; n=820) with foot parts without pedialgia. The measurement item was the length of the foot, the surrounding diameter of the foot, the width of the foot and the navicular abdomen height of the bone. We calculated the arch high rate and the arch sedimentation rate. The arch high

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rate was a static index to express the height of the arch, and the arch sedimentation rate was a dynamic index representing the MLA change with the load. The measurement was performed in both a sitting position, and a standing position on one foot. One-way layout analysis of variance / multiple comparison official approval / Student T official approval were used for statistical analysis.

Results

The structural growth of the foot part (Table 1). The length of the foot, the surrounding diameter of the foot, the width of the foot, and the navicular height increased with age. The arch high rate did not show any difference between age. The arch sedimentation rate showed a decrease with age. Medial longitudinal arch of foot of the normal group and foot disorder group (Table 2). There was no difference between the two groups in regard to higher radiale and the arch high rate. As for the arch sedimentation rate in the 10- to 11-year-old students, the rate in the foot part disorder group was significantly bigger than in the normal group.

Discussion

Our results showed that the length of the foot, the surrounding diameter of the foot, the width of the foot, and the navicular abdomen height of the bone increased with age. These results almost accord with preliminary research [3-5]. Growth of MLA seems to have a morphological side and a functional side. The morphological side is the change that the height of the arch increases with the formation of the arch. The functional side is the change that the resistance of the arch with load increases with age. Therefore the arch sedimentation rate decreases. The support function of MLA was quantified by the arch sedimentation rate and was significantly large in the foot part disorder group. The cases in which the support function of MLA failed may be complicated by a foot part disorder. In conclusion, the arch sedimentation rate can be a useful index for detecting a foot part disorder. We examined the static index (Arch Ratio) and the dynamic index (Arch Drop Ratio)of the medial longitudinal arch of the foot of primary schoolchild footballers. The subjects comprised two groups: a Normal Group and an Ankle/Foot Pain Group. In a non-weight-bearing position, the Arch Ratio and Arch Drop Ratio showed equilateral correlation. In a weight-bearing position, the Arch Ratio and Arch Drop Ratio showed a negative correlation. The Arch Drop Ratio of the Ankle/Foot Pain Group was significantly bigger than that of the Normal Group. The Arch Drop Ratio of the patients whose arch was kept in a non-weight-bearing position but became flat in a weight-bearing position was high. The patients whose Arch Drop Ratio was big complained of foot pain frequently.

References

1. Matsuura T.・Result and a problem of outdoor a medical examination for the soccer. (in Japanese) Journal of Clinical Sports Medicine. 2009;26:183-187,.

2. Uchio Y. The actual situation of locomotorium disease and injury in the school. Journal of Clinical Sports Medicine. 2009; 26:141-148.

3. Jose B: Footprint Analysis During the Growth Period. Journal of Pediatric Orthopedics 1994 ; 14 : 83－85

4. Francisco F, Jose P: Footprint Analysis Between Three and Seventeen Years of Age. Foot & Ankle 1990 ; 11 : 101－104

5. Lynn T, Deanna E, Marilyn C: The Longitudinal Arch. The Journal of Bone and Joint Surgery 1987 ; 69 : 426－428

Table 1. The structural growth of the foot part

Years old	Length		Surroundings diameter		Width		Navicular height		Rate of arch height		Arch sedimentation rate	
	Mean (mm)	SD	Mean (mm)	SD	Mean (mm)	SD	Mean (mm)	SD	Mean (%)	SD	Mean (%)	SD
8	197.3	11.8	199.1	12.5	81.0	5.3	31.3	5.2	15.7	2.2	2.5	1.3
9	206.1	11.2	205.4	11.0	83.3	4.9	33.8	5.7	16.4	2.8	2.1	1.4
10	213.3	11.5	211.6	12.2	86.9	4.7	35.0	6.1	16.4	2.8	2.0	1.6
11	221.4	12.4	218.7	14.1	89.8	6.6	36.6	6.0	16.5	2.7	1.8	1.4
12	227.1	12.0	225.6	13.4	92.9	5.6	37.4	5.9	16.5	2.6	1.8	1.5

Table 2. Medial longitudinal arch of foot of the normal group and foot disorder group

	Navicular height				Rate of arch height				Arch sedimentation rate			
Years old	Normal group		Foot disorder group		Normal group		Foot disorder group		Normal group		Foot disorder group	
	Mean (mm)	SD	Mean (mm)	SD	Mean (%)	SD	Mean (%)	SD	Mean (%)	SD	Mean (%)	SD
8	30.7	5.1	33.6	5.2	15.4	2.2	17.0	1.8	2.6	1.4	2.1	1.1
9	33.9	5.9	33.3	4.9	16.5	2.9	15.9	2.6	2.0	1.4	2.4	1.5
10	35.2	6.1	34.4	6.1	16.6	2.8	15.9	2.8	1.8	1.6	＊2.505	1.7
11	36.4	5.9	37.1	6.4	16.5	2.7	16.5	2.9	1.7	1.4	＊2.0524	1.6
12	37.9	5.2	36.5	7.2	16.7	2.2	16.0	3.2	1.6	1.4	2.0	1.5

＊: $p<0.05$