

---

## The Differences in the Formation of Hyaline Cartilage of the Knee Joint in Children in Norm and in Flat Feet

Ivantsou, A. V.<sup>1</sup>, Valchkevich, D. A.<sup>1\*</sup> & Tcydzik, I. S.<sup>2</sup>

<sup>1</sup>*Grodno State Medical University, Department of Normal Anatomy, Grodno, Belarus*

<sup>2</sup>*Grodno Regional Cardiological Clinic, Grodno, Belarus*

**\*Correspondence to:** Dr. Valchkevich, D. A., Grodno State Medical University, Department of Normal Anatomy, Grodno, Belarus.

### Copyright

© 2019 Dr. Valchkevich, D. A., *et al.* This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Received: 18 November 2019

Published: 19 December 2019

**Keywords:** *Knee Joint; Cartilage; Flat Foot; Anatomy; Ultrasound*

### Abstract

Early assessment of the condition of the knee joints in flat feet is very important when conducting dispensary examinations of children in preschool and school institutions, in sports medicine, for timely prediction of health disorders of athletes. An ultrasound examination of 180 knee joints of children with initial stages of flat feet and 186 knee joints of health children were carried out. It was shown the significant decreasing in the thickness of the cartilage of the lateral condyle of the femur in children with flat feet.

### Introduction

It has been noted a steady increase in number of diseases and deformities of the feet in children and adolescents in recent years [1,2]. At untimely diagnostics and the late beginning of preventive medical actions, diseases of feet progress, taking irreversible character [3]. By the age of 12-14, they are usually not corrected by orthopedic products, which in the future leads to a significant restriction of social activity and disability [1]. Early assessment of the condition of the knee joints in flat feet is very important when conducting dispensary examinations of children in preschool and school institutions, in sports medicine, for timely prediction of health disorders of athletes [4-6].

The goal of study is to estimate the formation of hyaline cartilage of femoral condyles in healthy children and with the initial stages of flat feet according to ultrasound.

## Material and Methods

The maximal flexion of the knee joint creates an optimal ultrasonic “window” for visualization of femoral condyles and morphometry of their lower parts [7,8]. We carried out an ultrasound examination of 180 knee joints of children with initial stages of flat feet and 186 knee joints of children in the control group. That group was created by the following criteria: no complaints of pain and discomfort in the knee joints, no history of sports loads, injuries and diseases of the lower extremities (table 1).

**Table 1:** Distribution of surveyed children by age and groups.

Children	Age		
	5-7	8-12	13-17
In control group	62	60	64
In flat feet	76	54	50

## Results and Discussions

The articular cartilage of the peripheral part of the distal epiphysis of the femur was characterized by evenness and distinctness of contours, a high degree of homogeneity and fine-grained, hypoechogenicity, the absence of additional media boundaries, good sound conductivity. The outer contour of the articular cartilage was located at the borderline between the superficial zone and the synovial fluid, and the inner one - at the border with the acoustic shadow. In that area the the non-visualized part of the trabecular bone of the distal epiphysis of the femur was located.

The data we gathered on the thickness of hyaline cartilage are noted in table 2.

**Table 2:** The thickness of the cartilage of the femoral condyles depending on the age and condition of the feet.

Age	Condyles	The thickness of cartilage (in mm)		P
		The control group	The experimental group	
5-7 y.o.	Medial	5,31±0,46	5,25±0,49	p > 0.05
	Lateral	5,48±0,5	5,3±0,61	p > 0.05
8-12 y.o.	Medial	4,43±0,5	4,52±0,5	p > 0.05
	Lateral	4,67±0,48	4,61±0,53	p > 0.05
13-17 y.o.	Medial	3,97±0,31	3,86±0,45	p > 0.05
	Lateral	4,28±0,45	3,98±0,51	p < 0.001

Analysis of the results shows that in the both experimental and control groups in children of all ages, the cartilage of the lateral condyle is thicker than the medial condyle cartilage. The age period of 5-7 years is characterized by a significant increase in dynamic loads, which is due to motor activation of children, which leads to an increase in the microhardness of cartilage and the amount of the basic substance. During the chondrogenesis process, there were no statistically significant differences in cartilage thickness in children with norm and in flat feet.

The period of 8-12 years is critical because alongside the ongoing increase in growth and body weight of children, a decrease in dynamic load, the reduction in shock absorption of articular cartilage, increasing friction in the articular cartilage is noted. The articular cartilage becomes loose, less viscous, and malleable to deformation. Despite the increasing the amount of the basic substance, there is a decrease in cells per unit area in almost all layers. The mass of chondromatrix increases what inhibits cartilage degeneration in flat feet. Because of that there are no differences with the control group ( $p > 0.05$ ).

In the age period of 13-17 years, there is a gradual increase in microhardness and the amount of the basic substance with a simultaneous decreasing in the cells number on the background of increasing compression of articular surfaces. It leads to a significant decreasing in the thickness of the cartilage of the lateral condyle of the femur ( $p < 0.001$ ). At the same time there were no significant differences in the medial condyle of the femur ( $p > 0.05$ ).

## Conclusion

Ultrasonographic study of hyaline cartilage of the knee joint in children with the initial stages of flat feet allows to give an objective assessment of the state of this joint and determine the possibility of developing its certain pathological changes.

## Conflicts of Interests

The authors declare that there is no conflict of interest.

## Bibliography

1. Uden, H., Scharfbillig, R. & Causby, R. (2017). The typically developing paediatric foot: how flat should it be? A systematic review. *J Foot Ankle Res.*, 10, 37.
2. Banwell, H. A., Paris, M. E., Mackintosh, S. & Williams, C. M. (2018). Paediatric flexible flat foot: how are we measuring it and are we getting it right? A systematic review. *J Foot Ankle Res.*, 11, 21.
3. Machida, J., Inaba, Y. & Nakamura, N. (2017). Management of foot deformity in children. *J Orthop Sci.*, 22(2), 175-183.
4. Batalov, A. Z. (2000). Ultrasonographic evaluation of the knee joint cartilage in rheumatoid arthritis patients / A.Z. Batalov, S.I. Kuzmanova, D.P. Penev // *Folia. Med. (Plovdiv)*., 42(4), 23-26.

5. Jacobson, J. A. (2007). *Musculoskeletal ultrasound* / J.A. Jacobson. New York, (pp. 264-333).
6. Koo, S. (2007). A comparison of the influence of global functional loads vs. local contact anatomy on articular cartilage thickness at the knee / S. Koo, T.P. Andriacchi // *J. Biomech.*, 40(13), 2961-2966.
7. Saarakkala, S. (2004). Ultrasonic quantitation of superficial degradation of articular cartilage / S. Saarakkala, J. Toyras, J. Hirvonen // *Ultrasound Med. Biol.*, 30(6), 783-792.
8. Senzig, D. A. (1992). Ultrasonic attenuation in articular cartilage / D.A. Senzig, F.K. Foster, J.E. Olerud // *J. Acoust. Soc. Am.*, 92(2), 676-681.