LEG LENGTH AND LEG TORSION MEASUREMENT WITH ULTRASOUND IN CHILDREN DURING ONE YEAR – FIRST RESULTS

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INTRODUCTION

The growth of the lower extremity and the shape changes of leg in infants often lead to uncertainty in parents. The infant's leg can develop from a typical bow leg via a knock-knee to a normal "straight" leg. The reasons for the knock-kneed gait of the infants are the antetorsion of the femur associated with a valgus position of the knee. The reduction of the femoral antetorsion occurs during growth and is pronounced during two phases of detorsion [1]. The aim of the present longitudinal investigation was to quantify the development of leg geometry in children over the course of one year by means of an ultrasound measurement system.

METHODS

33 healthy children (18 male; 15 female) aged 3.5 to 5.2 years were measured during 3 times within one year (every 6 months). To determine leg geometry a sonographic system (Sonoline Prima, Siemens) coupled with a 2.5-dimensional ultrasound measurement system (CMS70P4-K Zebris, Germany) was used. Defined bony landmarks of hip, knee and ankle joint were sonographically displayed. The bony outlines were marked with circles, points and/or vectors. With use of dedicated software (MedMess 2.0, Zebris) the femur, tibia and total leg length as well as femoral and tibial torsion and the mechanical axis were calculated.
For statistical analysis an ANOVA for repeated measurements with $p < 0.05$ and Scheffé test for paired comparison was used.

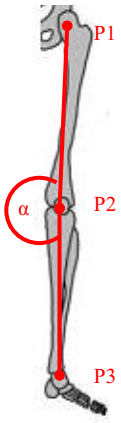

Figure 1: P1- P2 = Femur length; P2-P3 = Tibia length; P1-P3 = Total leg length; α = Mech. axis

RESULTS AND DISCUSSION

In the one-year observation period, a significant increase of the total leg length of 9.4% from 437mm to 477mm could be detected. The femur length increased significantly by 9.4% and the tibia length by 8.7% which confirms the literature [1]. Femoral torsion changed significantly from -31.1° to -28.8° during 1 year but significant changes of tibia torsion were not established. After 6 months a significant decrease of the mechanical axis was detected [Tab. 1].
The significant change of femur torsion can be attributed to the natural decrease of antetorsion during growth. The decrease of 0.7° of mechanical axis can also confirm the development of antetorsion but this low value has no clinical relevance.
Furthermore, it is important to note that the defined bony structures in this age group are not completely ossified. This can lead to complications during the measurement and following calculation.

CONCLUSIONS

Due to the lack exposure to harmful radiation, the ultrasound based measurement system is an adequate medium for determining leg geometry not only in children but also in adults and for follow-up investigations. The degree of ossification of the bony landmarks of children in the demonstrated age group can be problematic and should not be compared with that of adults. Therefore, the results have to be considered and used with caution.

REFERENCES

1. Niethard, F. U.: *Kinderorthopädie.* Stuttgart, 1997.

ACKNOWLEDGEMENTS

This project is supported by the German Research Foundation (DFG grant # RO 2146/3-2).

Table 1: One-year results of all parameters.

	First Examination		+6 Months		+12 Months		p-Level
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	
Femur length [mm]	244.08	13.92	256.45	15.0	267.1	15.83	< .0001
Tibia length [mm]	195.59	12.44	205.82	11.92	213.19	12.91	< .0001
Total leg length [mm]	437.12	24.77	459.73	25.29	477.69	26.74	<.0001
Femur torsion [°]	-31.06	9.54	-31.23	8.96	-28.79	9.07	<.0135
Tibia torsion [°]	13.36	6.48	12.12	7.02	11.38	7.98	n.s.
Mechanical axis [°]	181.21	2.06	180.51	1.79	180.60	1.93	<.0095