

FOOT PRESSURE MEASUREMENT IN CHILDREN WITH INTOEING AND OUTOEING WALKING

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Summary

The goal of this study is to measure the foot pressures during walking to put in evidence the propulsion patterns of intoeing and outoeing gaits of children.

Conclusion

The propulsion force moves from the first metatarsal joint in outoeing gait to the 3rd or 4th metatarsal joint in intoeing gait. That could be the origin of little toes deformation which can be observed in adults or teenagers.

INTRODUCTION

Ground reaction forces and kinematic parameters of gait have been studied in children walking with rotational abnormalities of lower limbs [1]. These abnormalities are suspected to be the cause of articular cartilage damage when they don't compensate with growth [2]. The goal of this study is to find the pattern of propulsion of the intoeing and outoeing gaits to correlate forefoot position at toe-off and toes deformities, and also to find the different patterns of force between the two kinds of gait at heel-strike.

PATIENTS/MATERIALS and METHODS

Six children, free of neurologic problem, participated to this study. They didn't have any deformation excepted an insufficiency of external tibial torsion (TTi group, n=3) or an exaggerated external tibial torsion (TTe group, n=3). Barefeet walking pressure measurements were performed with a 600x400mm Footscan plate (Rsscan International, France Mesures Biomécaniques, Bischheim, France) connected to a force plate (INCA44, Capfels, Montpellier, France) integrated into a 12 meters long walkway. Three measurements for each foot were performed. The results were analysed on lateral and medial forefoot and heel zones. The line of COF was also considered. Due to the low number of children and the low repeatability of the measurements, the results are not expressed as statistical ones but as representative of a pattern of foot progression.

RESULTS

For out-toeing walking, the reception force on heel was 35.4 % body weight (BW) in lateral zone and 16.5 % BW in medial zone. On forefoot, the lateral force was 19.1 % BW and the medial one was 44.6 % BW. Then, the pattern of foot contact progression in outoeing walking is as the normal one, from lateral part of the heel to the head of the first metatarsal joint. The line of COF showed a rapid changing in its direction and so demonstrated an eversion movement at the propulsion time. For in-toeing walking, the reception force on heel was 43.6 % BW in lateral zone and 23.4 % BW in medial zone. On forefoot, the lateral force was 56.1 % BW and the medial one was 43.4 % BW. The COF line showed a lateral position of the point of application of the force at the propulsion time and so was the opposite of the normal pattern. This demonstrated an inversion movement of forefoot due to exaggerated foot internal position which involves the application of propulsion force on small metatarsal joints.

DISCUSSION

These preliminary results show that for the two groups, the maximum of heel strike force is always applied in lateral area of heel. Intoeing walking induces a greater global force on heel than outoeing. However, in forefoot, the area of application of the propulsion force moves, respectively for outoeing gait and intoeing gait, from the first metatarsal joint which is a big structure to the 3rd or 4th metatarsal joint which is less adapted to accept big effort like the propulsion one. The localization of this effort on the little toes and the movement of inversion are probably the origin of little toes deformation which can be observed in adults or teenagers.

REFERENCES

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