Roessingh Research and Development

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THE EFFECTS OF WALKING SPEED ON FORE FOOT, HIND FOOT AND ANKLE JOINT MOTION

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INTRODUCTION

Gait studies have identified kinematic differences between healthy and impaired subjects and the results are used to analyse the effects of pathologies on foot and ankle kinematics. Pathologies, however, are also accompanied by change in temporal factors such as walking speed and double stance phase. These factors as such will influence the kinematics and hence make it difficult to deduct the effects of the disease on the kinematics. The aim of this study was to analyse temporal factors and foot and ankle kinematics from gait recordings of matured healthy subjects walking at comfortable and slower speeds.

Figure 1 - Foot with markers

METHODOLOGY

SAGITAL PLANE	FRONTAL PLANE	TRANSVERSE PLANE
ANKLE DORSIFLEXION	HIND FOOT EVERSION	LEG ROTATION W.R.T. HIND FOOT
MEDIAL ARCH COLLAPSE	SUPINATION OF MID FOOT W.R.T. HIND FOOT	ADDUCTION OF FORE FOOT W.R.T. HIND FOOT
MTP I DORSIFLEXION	SUPINAION OF FORE FOOT W.R.T. MID FOOT	FORE FOOT SPREADING
		MTP I ADDUCTION

Table 1: Assessed foot and ankle joint kinematics

Gait analysis was performed on fourteen healthy subjects without walking impairments using a 6-camera video-based (1.3 megapixel, 100 Hz) motion analysis system (Vicon Motion Systems, Oxford Metrics Group. Nineteen infra-red reflective markers were attached to the lower limbs of the subject (figure 1). The subjects were asked to walk at a comfortable speed first and then at predefined speeds of 75% and 50 % of the comfortable walking speed respectively.

Temporal factors were calculated. Foot and ankle joint kinematics were determined from marker-recordings by using the method developed by Simon [1] (table 1).

RESULTS

The subjects with mean age of 43 years (SD 8 years) walked at velocities of 1.28 m/s, 0.97 m/s and 0.65 m/s. The walking speed influenced the foot and ankle kinematics as follows:

1. Ankle, medial arch and MTP I sagital plane range of motion (ROM) decreased significantly with decreasing walking speed due to reduced peak values at toe-off (figure 2).

2. Frontal plane motion of the mid foot was affected during mid-stance by the walking speed, but differences in ROM were not significant (figure 3).

3. Fore foot, leg and MTP I transverse plane ROM significantly decreased for the lowest compared to the comfortable walking speed respectively.

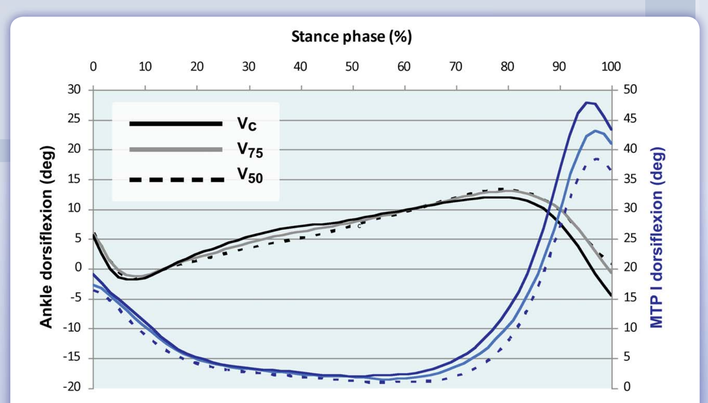

Figure 2 - Ankle and MTP I ROM in sagital plane

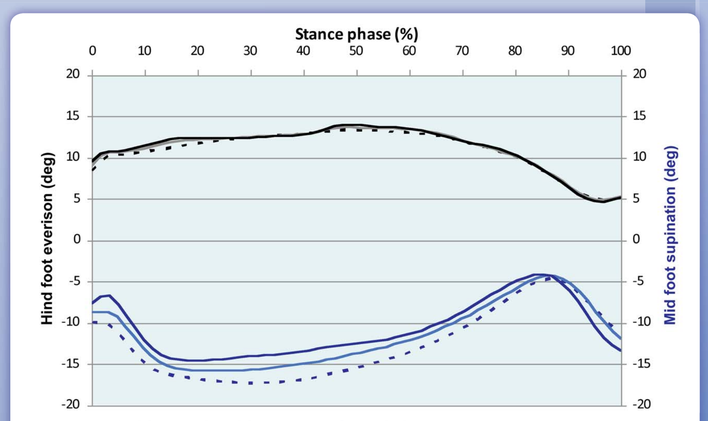

Figure 3 - Hind foot and mid foot ROM in frontal plane

CONCLUSIONS

Walking speed significantly affected foot and ankle kinematics. The results of this study indicate that gait comparison studies between healthy and impaired subjects should take walking speed into account to be able to analyse the effects of pathologies as distinctly as possible.

REFERENCES

[1] Simon et al. The Heidelberg foot measurement method: Development, description and assessment. Gait & Posture (2006) vol. 23 (4) pp. 411-424

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