Gait analysis of rheumatoid arthritis by force plate and F-scan

Ichiro Watanabe
Physical Medicine, Aomori University of Health and Welfare
(E-mail: wichiro-hok@umin.ac.jp)

Key words. Rheumatoid arthritis, fall, gait analysis, force plate, foot

Abstract
Fall accidents of rheumatoid arthritis (RA) will easily lead the bone fractures and disuse syndrome. To prevent the fall accidents, we analyzed the relationship of the factors of disease severity, disorders and fall accidents. They have multiple disorders in joints and muscle. In this study, we analyzed their gait performance by using force plate system and F-scan system in 19 RA patients and normal healthy volunteers. The pattern of force plate (X, Y, Z) and F-scan showed similar in normal control, but the patients’ patterns showed various patterns. We showed that the impact power of heel of controls was higher than that of RA patients at heel contact. The plantar pressure of the forefoot of the controls was higher than that of RA patients at the toe-off timing. And RA patients showed the longer double stance phase and many disorders in foot plate pressure.

Purpose
Fall accidents of rheumatoid arthritis (RA) will easily lead the bone fractures and disuse syndrome. RA patients had many disorders in joints, muscle power and pain. To prevent the fall accidents, we analyzed the relationship of the factors of disease severity and fall.

Method
Subjects were 19 RA patients and 3 normal control volunteers. The RA patients could gait independently and aged 40 to 78 years old (average 63.6±12.0). All patients had multiple disorders in lower limbs.

F-scan (Tekscan Co.) can measure the 1260 points of the foot bottom pressure every 10 m seconds. We attached the F-scan sensors as the insole in both shoes and then tried to lead walking on the force plate floor (2m wide, 5m long). For statistic analysis of the force plate data, the vertical component of the force (Fz), the lengthwise (Forward-backward) component of the force (Fx) and crosswise (lateral) component of the force (Fy) were sampled.
Results

In three normal volunteers, the similar patterns both in force plate analysis and F-scan analysis. But the parameter of RA patients showed various patterns in them. In normal volunteers, the vertical force (Fz) has clearly 2 peaks waves; one of the peaks showed strike at heel contact on floor and one showed the strike at toe-off. In RA patients, the vertical force pattern did not show the two peaks.

In the data of the F-scan of normal volunteers, the forefoot plantar pressure were hardly detected at heel contact, and the heel pressure were hardly detected at toe off. But the pattern of F-scan of some RA patients did not show the two peaks. And RA patients showed the long double stance phase.

Consideration

Every RA patient had multiple disorders of bilateral hips, knees, and ankles. The gait analysis directly indicated the patients’ activities and their functions in these cases with multiple disorders. In this study, the characteristics of the gait in RA patients were shown the small impact at the heel contact and the small propelling force at the toe-off. The gait was coordinating movement of multiple joints and muscles. In this study, we showed the characteristics of the gait pattern of RA. It is considered that these methods were useful for the evaluation of activities of RA patients.