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GAIT PATTERN OF A FEMALE PATIENT WITH FRIEBERG'S DISEASE

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ABSTRACT

Aims: Frieberg's disease is a chronic painful condition characterized by avascular necrosis of metatarsal head. With this case report, we aimed to analyze the gait pattern of a case presented with Frieberg's disease.

Case Report: A 20-year-old female patient (body weight: 50 kg, height: 1.64 m, body mass index: 18.5 kg/m^2) with a known Frieberg's disease during the last 6 years is presented. Her physical examinations showed no anatomical deformity of the foot such as hallux valgus or pes planus. The diagnosis of chronic stage Frieberg's disease was verified by a conventional posteroanterior X-ray imaging of foot. Gait analysis was performed during a painless period after physical and medical therapy. The average pressure distribution during stance phase was altered due to long-term protective behavior. There was a larger foot rotation on the affected side compared to the intacted side.

Conclusion: We considered that this gait pattern is not forced as in the primary pathologies or compensatory. Rather it may be accepted as volitional.

Keywords: Necrosis, metatarsal bone, gait

INTRODUCTION

Frieberg's disease is a chronic painful condition characterized by avascular necrosis of metatarsal head (1). It is more common among women with a male-to-female ratio of 1:5 (2). The occurrence age of previous cases ranged between 8-77 years in the literature (3). However, four out of six female patients were younger than 18 years (3). This type of avascular necrosis together with osteochondrosis mostly affects the second and third metatarsal heads in 68% and 27% of cases, respectively (4). Stanley et al. (5) reported that the longest metatarsal was affected 85% of the time. Only 6-7% of the cases suffered from bilateral involvement (4). The diagnosis and classification rely on radiographic or magnetic resonance imaging. Smillie (6) defined five stages of the disease on a radiological basis. Chronic repetitive micro-trauma is the most commonly accepted pathophysiological mechanism and, other suggested theories include single trauma leading to metacarpophalangeal (MTP) joint impingement, epiphyseal ischemia caused by arterial spasm, and combination of multiple factors (1, 5, 7, 8). As the disease affects metatarsals and leads to a painful condition, we hypothesized that it may alter gait pattern. In this case report, we present gait analysis results of a female patient with a known Frieberg's disease during the last 6 years. To the author's knowledge, no previous report investigated the gait characteristics of any patient with this condition.

CASE REPORT

A 20-year old woman (body weight: 50 kg, height: 1.64 m, body mass index: 18.5 kg/m^2) with a history of Frieberg's disease was referred to gait analysis laboratory of Anatomy department by her physiotherapist. She complained of a right foot pain one month ago. The pain was at moderate level and increased during walking. There was no history of apparent trauma but the patient reported repetitive small traumas due to foot stepping while studying at desk. Her medical history revealed that she was diagnosed with unilateral Frieberg's disease six years ago. The possible cause was a single major trauma during a football match at that time. Her orthopedist recommended a metatarsal pro-

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tector pad as the initial treatment. The patient used this pad at times of painful periods to relieve the pain. She also avoided from exercise activities that would bear weight onto her injured foot. The second admission to hospital was one month ago, 6 years after the initial diagnosis. Physical examination showed no anatomical deformity of the foot such as hallux valgus or pes planus. The diagnosis of chronic stage Frieberg's disease was verified by a conventional posteroanterior X-ray imaging of foot which revealed chronic stage avascular necrosis of the second metatarsal characterized by collapse of metatarsal head and fragmentation of the bone (Figure 1). After obtaining written informed consent from the patient, two gait analyses by 2-month intervals were planned and performed during painless period after physical and medical therapy.

Figure 1: Right foot. Anterior-posterior radiograph demonstrating avascular necrosis of the head of the second metatarsal.

Gait analysis was performed by a computerized force distribution measurement system (FDM-System Gait Analysis, Zebris Medical GmbH, Germany). Results are given in Table 1. Stance and swing phases of walking were evaluated within normal limits. The only significant alteration was foot rotation in the affected side. Both tests showed that the patient rotated her right foot during walking in order to protect the affected metatarsal. This strange antalgic stepping led to an altered average force and pressure characteristics in the chronicle period (Figure 2). Other parameters were comparable between the two sides.

Table 1: Gait characteristics of a 20-year-old female patient with Frieberg's disease.

Parameters	Test 1	Test 2	Mean Value*
Foot rotation L/R, deg	2.7±2.2 / 4.7±1.6	2.6±1.9 / 4.3±1.5	2.6±2.0 / 4.5±1.5
Step length L/R, cm	54±5 / 58±1	55±1 / 53±3	54±3 / 55±2
Step time L/R, sec	0.56±0.02 / 0.56±0.02	0.58±0.02 / 0.59±0.02	0.57±0.02/0.57±0.02
Stance phase L/R, %	62.4±1.0 / 63.5±1.6	65.2±1.2 / 65.3±1.1	63.8±1.1 / 64.4±1.3
Swing phase L/R, %	37.6±1.0 / 36.5±1.6	34.8±1.2 / 34.7±1.1	36.2±1.1 / 35.6±1.1
Stride length, cm	113±5	108±3	110±4
Stride time, sec	1.13±0.04	1.17±0.03	1.15±0.03
Cadence, stride/min	53±2	51±1	52±1
Velocity, km/h	3.60±0.29	3.32±0.25	3.46±0.27
Variability of velocity, %	8	8	8

Abbreviations: L/R, Left/Right;

****The mean of the first and second tests.***

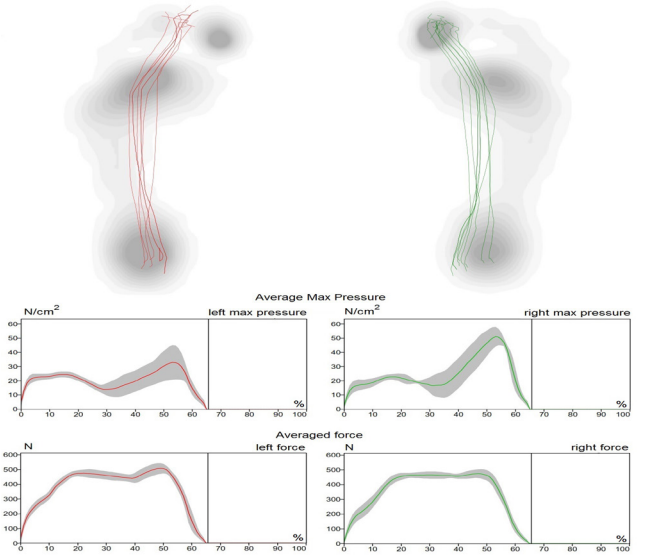

Figure 2: Average maximum pressure graphics of left (upper) and right (lower) foot.

DISCUSSION

We studied gait characteristics of a female patient with a known diagnosis of Frieberg's disease for the last six years. No previous reports described walking pattern in this condition. Pressure pattern was changed in the affected side. Although there was no apparent or observable antalgic limp, the average pressure distribution during stance phase was altered due to long-term protective behavior. There was a larger foot rotation on the affected side compared to intact side. This type of

rotation shifts the pressure arc slightly to medial direction. Thus, the second metatarsal is saved from pressure during stance phase of gait (Figure 2). Step time and step length were similar in both sides. Stance phase and swing phase occupy 60% and 40% on average, respectively. There were no significant alterations of stance and swing phases of gait. Well-known determinants of gait are pelvic rotation and obliquity, knee flexion in stance phase, ankle mechanism, foot mechanism, and lateral displacement of body (9). In this case, the affected determinants of gait seem to be the ankle and foot mechanisms. From the initial contact of heel to the ground to the toe off, pressure sites of plantar surface changed and spared the affected second metatarsal from weight-bearing position. We considered that this gait pattern is not forced as in the primary pathologies or compensatory. Rather it may be accepted as volitional. Furthermore, gait analysis may reveal such subtle changes in gait pattern and may help to plan an effective treatment.

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Conflict of Interest: The authors declared no conflict of interest.
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