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CASE REPORT

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Gait analysis in an osteoarthritis patient with restoration of the hip joint space following contralateral total hip arthroplasty: a case report

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Abstract We present the case of a patient who, after undergoing unilateral total hip arthroplasty (THA), achieved pain reduction in the contralateral hip accompanied by restoration of the radiographic joint space. We conducted gait analysis to clarify the dynamic factors affecting the natural course of osteoarthritis (OA). Our findings revealed that the patient walked with exaggerated adduction of the hip following the contralateral THA, causing substantial regeneration of joint loading.

Key words Gait analysis · Recovery · Total hip arthroplasty (THA)

Introduction

We sometimes treat patients with bilateral hip disease who, after undergoing unilateral total hip arthroplasty (THA), achieve pain reduction in the contralateral hip.[1] The factors initiating osteoarthritis (OA) are debatable. Remarkable variability exists between patients and joints in the natural history of the disease. A dramatic spontaneous restoration of the apparent radiographic joint space has been reported in only a few cases involving the hip.[1–3] In order to understand the biomechanical factors, we conducted a gait analysis of a patient with bilateral hip disease who, after undergoing unilateral THA, achieved pain reduction in the contralateral hip.

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Case report

A 57-year-old woman weighing 42 kg presented with a 10-year history of activity-related bilateral hip pain. At the age of 3 years, she had been diagnosed as having developmental dysplasia of both hips, and this had been treated by closed reduction and casting. She had been minimally symptomatic until her early thirties, when initial radiographs showed advanced degenerative joint disease of both hips (Fig. 1). After 3 years of conservative treatment, the patient had undergone THA of the more symptomatic right side (Fig. 2). After recovery she had used a T-cane with her right hand, and during the same period she had noticed a steady diminution of the left hip pain. Serial anteroposterior radiographs had shown that this was accompanied by remodeling of the femoral head into an ellipse, and reformation of the joint space (Fig. 3b).

Fig. 1. Preoperative radiograph in a standing position, showing narrowing of both joint spaces

Fig. 2. Radiograph taken immediately after total hip arthroplasty (THA)

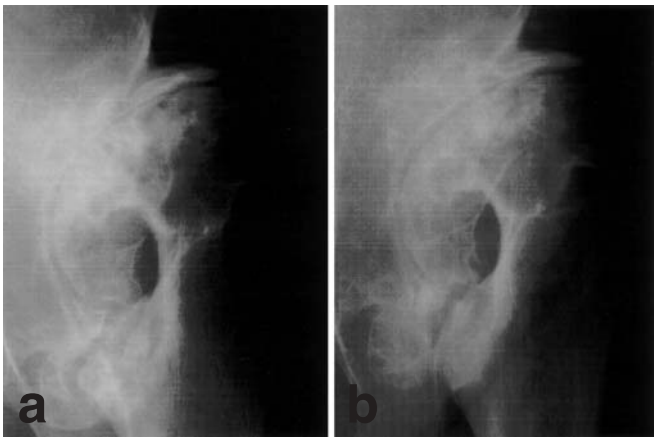

Fig. 3. a Radiograph taken immediately after contralateral THA, showing severe narrowing of the joint space. **b** One-year postoperative radiograph in a standing position, showing restoration of the hip joint space

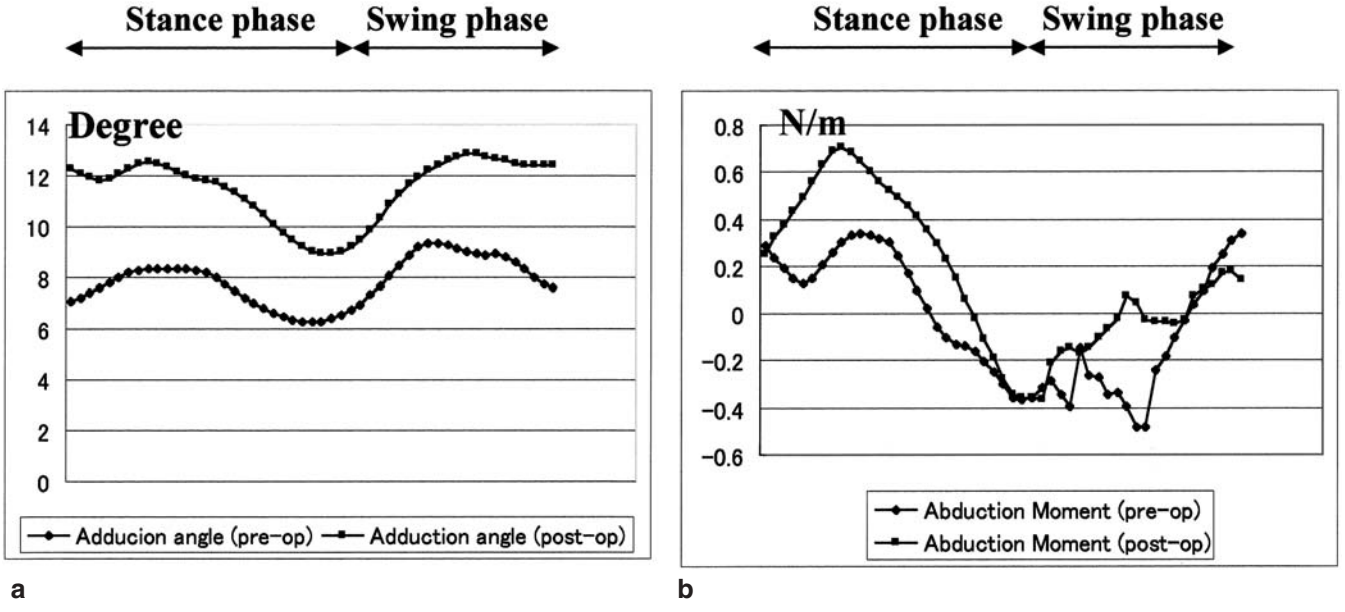

Fig. 4. a Graph showing the hip adduction angle of the contralateral THA during the gait cycle. **b** Graph showing the abduction moment of the contralateral THA during the gait cycle. The adduction angle and abduction moment during the gait cycle increased after contralateral THA

Throughout the entire course of her disease, the patient's left hip had shown 10° of flexion contraction. However, the range of flexion gradually increased from 40° at initial presentation to 60° 1 year later. The patient initially had 5° of adduction contraction, but 1 year later this had increased to 10° of abduction and 10° of adduction. During follow-up, the patient took no analgesics. Six months later, her left hip was quite comfortable, and although she continued to have 10° of flexion contraction, she was easily able to achieve 60° of flexion.

In the period before the THA and 1 year after the THA, we conducted gait analysis with a type-9284 Kistler force plate (Kistler Instruments, Winterhur, Swizerland) and a 370 version 1.2 Vicon three-dimensional motion analysis system (Oxford Metrics, Oxford, UK), including five infrared video cameras. The hip adduction angle and abduction moment during the gait cycle increased, although the vertical component of the ground reaction force was same for both sides at the second examination (Fig. 4).

Discussion

We sometimes treat patients with bilateral hip disease who, after undergoing unilateral THA, achieve pain reduction in

the contralateral hip accompanied by restoration of the radiographic joint space.[1–3] Restoration of a stable and pain-free hip joint following unilateral THA may therefore contribute to normalization of the contralateral hip joint.

Physical factors affecting the natural course of OA include the patient's age, figure, muscle strength, level of activity, whether OA is unilateral or bilateral, and leg-length discrepancy. Radiological factors affecting the natural course of OA are congruity of the joint, and the biological reaction of the joint to the disease.[2,3] Bombelli[4] classified OA into three types according to the biological reaction, and reported that osteotomy gave good results in cases of the hypertrophic type. However, these were only static factors. In this OA patient with restoration of the contralateral hip joint space following unilateral THA, we conducted gait analysis to clarify the dynamic factors affecting the natural course of OA. Our findings revealed that the patient walked with exaggerated adduction of the hip following the contralateral THA, causing substantial regeneration of joint loading. Exaggerated adduction during the stance phase would have had the same effect as so-called valgus osteotomy.[4] Furthermore, the improvement in the range of motion would benefit the ambulatory status and regeneration of fibrous cartilage. Regeneration of fibrous cartilage would lead to restoration of the hip joint space.

Although THA or osteotomy is widely accepted for the treatment of OA of the hip, conservative therapy such as diet, restriction of weight-bearing, muscle strengthing exercises, thermal therapy, and medication also plays an important role.[5,6] Although spontaneous regeneration of the joint space in OA remains enigmatic, the present case suggests that it is associated with peripheral osteophyte formation. However, gait modification may be of benefit for the conservative treatment of hip OA. Details of further cases are needed before we can gain a deeper understanding of the mechanical and biological factors involved.

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