Prosthetics and Orthotics International, 1997, 21, 153-158

Heel lifting as a conservative therapy for osteoarthritis of the hip: based on the rationale of Pauwels' intertrochanteric osteotomy

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Abstract

Patients with osteoarthritis of the hip were treated with a conservative therapy of heel lifting. Orthoses were applied on 35 hips in 33 subjects and the cases were followed for 23 months on average. Dramatic pain relief was reported, but the time required to reduce or completely relieve pain increased according to the stage of osteoarthritis. The radiological results were not satisfactory.

During the follow-up, only two hips showed improvement, 22 showed no change, and 11 deteriorated. The mechanism of heel lifting in relation to the hip joint was analysed, showing that pelvic obliquity was achieved and the trunk stabilized. In conclusion this simple orthosis was effective as a palliative therapy for osteoarthritis of the hip.

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Introduction

A palliative therapy is proposed for osteoarthritis of the hip. For mothers of young children and others who cannot spend time in the hospital for rehabilitation after operation, a treatment was devised to relieve hip pain without medication such as non-steroidal anti-inflammatory drugs.

Operations for osteoarthritis of the hip were developed in the latter half of the 20th century. Among them was the intertrochanteric osteotomy which was developed by Pauwels (Pauwels, 1976), and from which good results have been reported (Ohsawa, 1994). The indications for osteotomy are as follows: valgus

Fig. 1. Indication for a raise on the affected leg (valgus). The congruence was best in adduction of the hip. Left – adduction; middle – neutral; right – abduction.

Fig. 2. Indication for a raise on the contralateral leg (varus). The congruence was best in abduction of the hip. Left – adduction; middle – neutral; right – abduction.

osteotomy is indicated when congruence improves with adduction of the hip (Fig.1). Varus osteotomy is performed when the congruence improves with abduction of the hip (Fig. 2). The authors proposed instead to use lifting to tilt the pelvis. The raised side would produce hip valgus on that side and raising of the contralateral side would produce hip varus (Fig. 3). As a result, this lifting could be as effective as intertrochanteric osteotomy. Clinical tests were performed to test this hypothesis (Ohsawa and Ueno, 1993).

Materials and methods

Indication and application

The orthosis was offered to patients who refused operation but suffered from hip pain from osteoarthritis (Table 1). The procedure was applicable to all stages of osteoarthritis. When the joint congruence improved with adduction of the hip, a valgus effect on the hip was necessary (Fig. 1). A raise was therefore applied to the affected leg. The amount of lift was the same as that of the discrepancy of the functional limb length, so that patients felt that both limbs were the same length. When the joint congruence improved with abduction of the hip, a varus effect on the hip was necessary (Fig. 2). A raise was therefore applied to the contralateral leg. The maximum amount of lift was around 1.5cm, because a higher lift caused the shoe to slip off (Fig. 4).

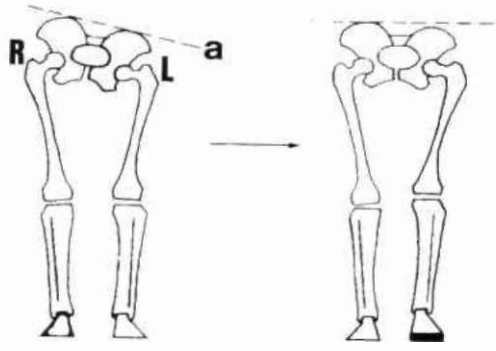

Fig. 3. Mechanism of heel lift. The pelvic line (a) was changed by the heel raise. The hip on the lifted side suffered a valgus effect (left hip, L) and the contralateral hip suffered a varus effect (right hip, R). The black square indicates a heel raise.

Table 1. Demographic data of patients

	valgus	varus
hips	24	11
average age (years)	54	51
average follow-up (months)	24	23
average hip score (points)		
before	11	12
after	12	14
stage (hips)		
early	2	4
advanced	9	7
terminal	13	0
average lift (cm)	1.4	1.5
average range of motion (degrees)		
flexing before	88	95
final	84	101
abduction before	12	29
final	12	24

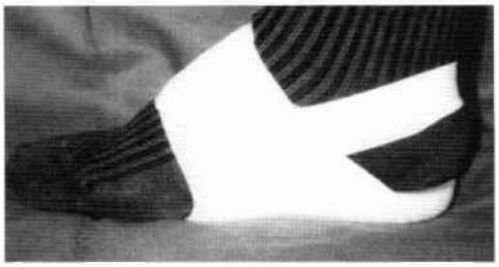

Fig. 4. Heel raise. Patient can use the raise with or without shoe to suit the Japanese life style.

Methods of analysis

Clinically, the Merle d'Aubigné hip score was used (Merle d'Aubigné and Postel, 1954), along with pelvic radiography. Patients were analysed in the standing position using a radiograph of the pelvis, and body centre analysis with and without heel lifting. Motion analysis was carried out on patients in walking.

Standing position: The angle between the pelvis and the femur was measured for all patients using a pelvic radiograph in the standing position with and without a raise (Fig. 5). The movement of the body centre of the 25 patients was studied using a body centre analyzer (San'ei, 1G06, Japan). The patients stood for 30 seconds in relaxed open-eye condition with and without the raise. The body sway was defined as the absolute value of A minus B shown in Figure 6.

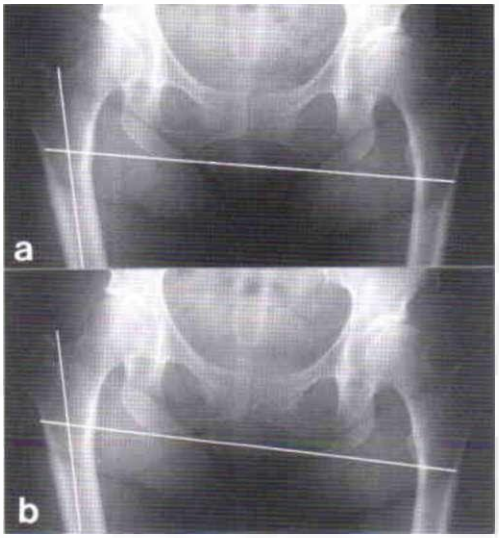

Fig. 5. Bilateral hip dysplasia with painful left hip. The angle between the pelvis and the right thigh was 79 degrees in (a) which increased to 75 degrees in (b) by lifting the right leg.

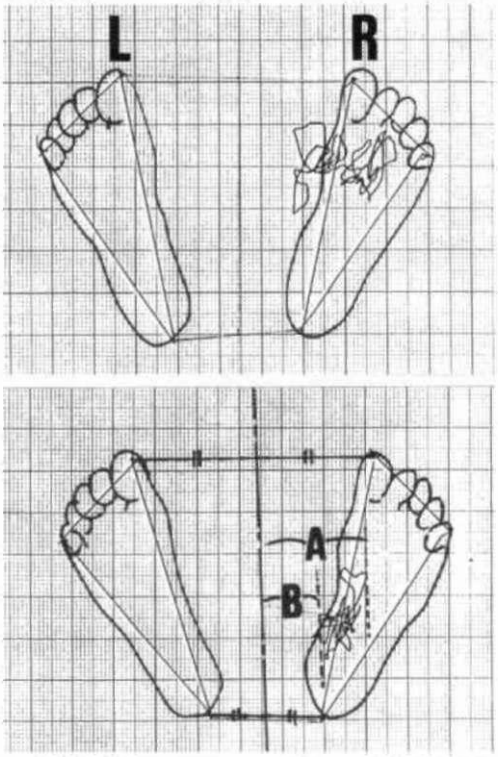

Fig. 6. Body centre analysis with (lower) and without (upper) heel raise. The distance from the midline of each foot was measured, and defined as A: largest and B: smallest. Sound side (right foot) R; right foot, L; left foot.

Gait analysis: Twenty-two patients were assessed. In measuring the motion in the frontal plane, it was assumed that the gait was similar to walking in place. A two-dimensional motion analyzer was used (EMTEK, MVA-2000, Japan). The patients had marks on both shoulders, iliac crests, patellae, and ankles and positional data was collected for five seconds (Fig. 7). The effect of heel lifting in walking was estimated by the angle between the pelvis (the line of both iliac crests) and thigh (the line of the iliac crest and the patella) in the stance phase of the test (Fig. 8). Trunk instability was measured by the relative vertical and horizontal movements of the points of the shoulder and the iliac crest.

Patients: A total of 33 cases (two men and 31 women), involving 35 hips were treated by heel lifting (Table 1). Twenty-four hips needed a valgus effect, so the affected leg was fitted with a raise. Eleven hips needed a varus effect, so the contralateral leg was fitted with a raise. Two

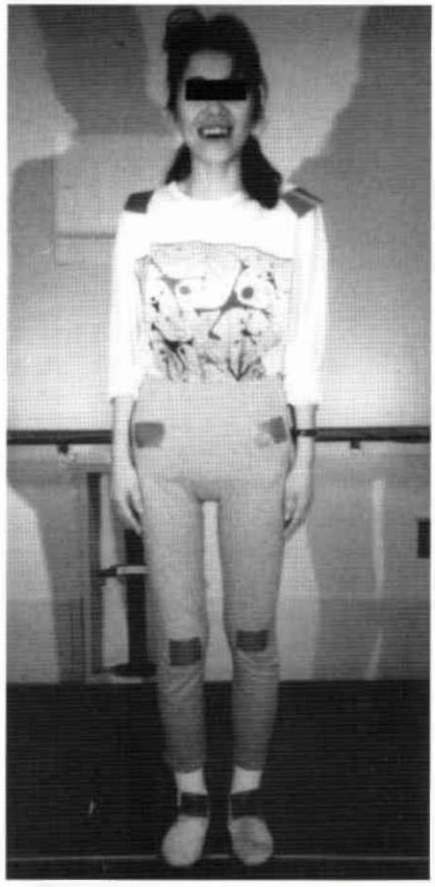

Fig. 7. Motion analysis on the frontal plane. Marking on shoulders, iliac crests, patellae, ankles and walking in place.

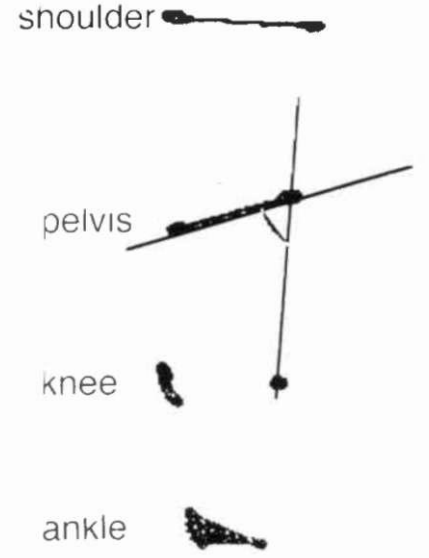

Fig. 8. Motion anaylsis in the frontal plane with the left leg in stance phase. The angle between the line of both iliac crests and the line of iliac crest and patella was measured as shown in the figure. This is the angle between the pelvis and the thigh.

cases suffered from osteoarthritis bilaterally. One hip needed a valgus effect and the other needed a varus effect. Therefore both hips were treated using a single raise. Another case was treated by a raise to produce varus effect but the hip deteriorated and the indication changed requiring a valgus effect, so the hip was treated using two methods. The average age of the patients was 51 years old. Each case was followed for 23 months on average. Statistical analysis of the t-test was carried out.

Results

Twenty-seven cases used a raise at the final follow-up. Two cases did not use one because of absence of hip pain. One stopped using the raise because contralateral pain occurred. Four hips were operated on. Two hips were treated by intertrochanteric osteotomy, and the other two by total hip arthroplasty. The time required for hip pain to decrease or disappear after the heel lifting is shown in Table 2. There is a relationship between the time it took hip pain to decrease or disappear and the stage of osteoarthritis.

Clinical hip scores increased with improvement of pain scores, but range of hip motion and gait ability did not change. Final total hip scores and pain scores significantly improved. The radiological changes of the

Table 2. Pain control by heel lifting

stage	pain decreased	pain disappeared	no change	total
early	3(1)*	3(1)	0	6
advanced	9(1.6)	5(3.6)	2	16
terminal	5(1.2)	5(13.4)	3	13
total	17	13	5	35

*average time of treatment (months) for decrease or disappearance of pain

Fig. 9. Left hip radiograms. Left – before and right – 43 months after treatment. Subject was a 60 year old woman with osteoarthritis of left hip treated with a 2cm raise on the left leg. At the 43 month follow-up the hip score showed a 3 point improvement but the hip deteriorated radiographically (cf Figure 1).

osteoarthritis before lifting and at the final follow-up were estimated. Two hips in the late stage of coxarthritis improved, but others deteriorated (11 hips) or showed no change (22 hips) at the final follow-up.

Pelvic radiographs in the standing position with and without heel lifting are shown in Figure 5. The angle decreased on the raised side and a valgus effect was observed in the hip. The angle increased on the contralateral side with a varus effect at the hip. In body centre analysis, fourteen out of 26 patients regained stability by heel lifting, but the other 12 patients did not.

Motion analysis of the angle between the pelvis and the thigh was carried out as shown in Figure 8. In the patients whose hips needed a valgus effect, the angle between the pelvis and the thigh was not changed by the raise and 12 cases out of 15 did not show any effect in the motion analysis. However in the patients whose hips needed a varus effect, the angle between the pelvis and the thigh was changed by the lift; 5 cases out of 7 were affected by the lift. Some 15 patients had their trunks stabilized by lifting and seven patients did not in the motion analysis.

Discussion

The results showed that lifting did not change the natural course of the osteoarthritis. This orthosis is not considered by the authors to be the best method as a conservative therapy, but lifting of the heel is very simple and effective for relief of hip pain and can postpone operative treatment. The orthosis could be a palliative treatment for people who cannot take time from a job or child care and it obviates the need for medication, which can be a cause of gastric or duodenal ulcers. Other orthoses are available but they are large and restrict patients' activity (Hohmann, 1958; Kawamura, 1983).

The biomechanical analyses revealed that some patients were not clearly stabilized by the lift. Each method of analysis is compared with the clinical results as shown in Figure 10 where the solid bar denotes no improvement in the pain score and the empty bar improvement by one or more points. The figure showed the relationship between biomechanical effects and pain scores at the final follow-up. This figure supported the hypothesis that the heel raise affected the stability of the body and improved the hip joint position and also justified the indications according to the rationale of Pauwels' osteotomy.

The more advanced stage of the disease, the longer it took to reduce hip pain. The orthosis did not cause lumbar pain. It even provided lumbar pain relief, because the limb length discrepancy was decreased by the orthosis. This phenomenon would also support the application of a raise for patients with a hip-spine syndrome (Offierski and Macnab, 1983). The orthosis is simple and had a good effect on hip pain, but did not affect the natural course of osteoarthritis of the hip joint.

Acknowledgement

The authors are grateful to Ms. Y. Takemori for preparing the manuscript.

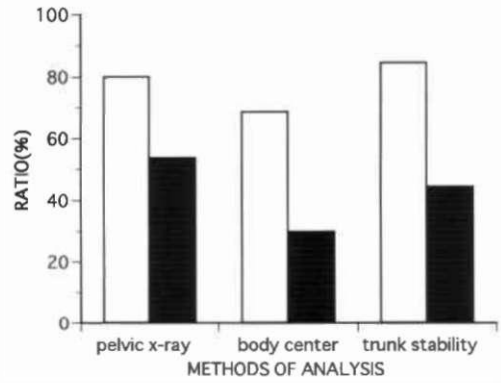

Fig. 10. The ratios of effectiveness and improvement in the pain score. The bars showed the percentage of the positive effects of lifting in each methods of analysis. Note blank bar (improvement by one or more points) were more effective than solid bar (no improvement).

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