



Case Study

## A case of an elderly hip disarticulation amputee with rheumatoid arthritis who regained the ability to walk using a hip prosthesis

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**Abstract.** [Purpose] We report a case of an elderly patient with rheumatoid arthritis who underwent hip disarticulation because of necrotizing fasciitis and regained the ability to walk independently with a prosthetic limb. [Participant and Methods] A 61-year-old female patient underwent right hip disarticulation due to severe necrotizing fasciitis of the right lower limb. Her chief complaint was that she was not able to walk inside her house or outdoors to perform instrumental activities of daily living. We applied a Canadian-type hip disarticulation prosthesis to the stump. The patient received in-hospital physical therapy, occupational therapy, and clinical psychology counselling for 145 days. As her hands and fingers were weakened by rheumatism, we made several modifications to the prosthesis to enable the patient to attach and detach it independently. [Results] The patient was able to use the prosthesis to walk continuously for 45 m, perform various housework duties, drive a car, and go out, thus accomplishing the desired daily activities. [Conclusion] Our patient, an elderly hip disarticulation amputee with rheumatoid arthritis, was able to walk independently using a prosthetic limb. The application of prosthetic limbs may be appropriate even for hip disarticulation amputees with comorbidities that make it difficult to acquire a prosthetic gait.

**Key words:** Elderly rheumatoid arthritis, Independent walking, Hip disarticulation

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### INTRODUCTION

For entire lower limb amputees, the factors strongly predictive of the ability to walk with prostheses are the amputation level, patient age, physical fitness, and comorbidities<sup>1)</sup>. In particular, for a hip disarticulation amputee (HDA) with a prosthesis, the walking energy consumption is high<sup>2, 3)</sup> and the walking speed is slow<sup>3, 4)</sup>. HDAs are rare, comprising only 1–3% of all lower limb amputees<sup>5–8)</sup>. Regardless of the presence or absence of comorbidities, only 10–35% of HDAs are able to walk with a hip prosthesis<sup>7, 9)</sup>. If HDAs have comorbidities or low endurance, mobility via wheelchairs is a more realistic goal<sup>2, 3, 10)</sup>. Furthermore, when a patient with rheumatoid arthritis undergoes lower limb amputation, the rehabilitation progress may be delayed, and the outcome regarding walking ability is likely to be poor<sup>11)</sup>. Lachmann<sup>11)</sup> reported that only one of 11 patients with rheumatoid arthritis who underwent lower limb amputation (above or below the knee) was able

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**Fig. 1.** Radiographic images of a 61 year-old female with rheumatoid arthritis who underwent hip disarticulation. a) Left total hip arthroplasty and right hip disarticulation. b) Left total knee arthroplasty. c) Bone destruction of the bilateral hands and wrists.

to walk outdoors using a prosthesis.

We experienced a case of an elderly with rheumatoid arthritis who underwent right hip disarticulation due to necrotizing fasciitis, and succeeded in acquiring the ability to walk independently using a hip prosthesis. Herein, we report the course of rehabilitation in this rare case.

## PARTICIPANT AND METHODS

The publication of this case report was approved by the Ibaraki Prefectural University of Health Sciences Ethics Committee (approval no. e63), and the patient provided written informed consent.

A 61-year-old female (height 139 cm, weight 42.8 kg) was diagnosed with severe necrotizing fasciitis of the right lower limb and underwent right hip disarticulation at an acute hospital. She was then transferred to our hospital for rehabilitation on the 44th postoperative day. The chief aim was for the patient to regain the ability to walk.

Regarding her medical history, the patient had been diagnosed with rheumatoid arthritis at the age of 38 years, and diabetes mellitus at the age of 44 years. She had undergone bilateral total knee arthroplasty at the age of 44 years, and bilateral total hip arthroplasty at the age of 55 years.

The planned rehabilitation program comprised physical therapy, occupational therapy, and counseling by clinical psychologists. At the time of admission to our hospital, her manual muscle test (MMT) scores for the left lower limb were 4 in hip flexion, 3 in other hip directions, 4 in knee flexion and extension, 3 in ankle dorsal and plantar flexion, and 2 in toe flexion. The muscle strength of the upper limbs was appropriate for her age. The grip strength was sometimes limited by pain, and was estimated to be around a MMT score of 3. The state of the rheumatoid arthritis was stage 4 in accordance with the Steinbrocker classification, and class 3 in accordance with functional classification (Fig. 1).

Regarding the range of motion (ROM), the major limitations were in bilateral shoulder flexion (120°) and abduction (120°), left knee extension (−5°) and flexion (about 130°), left hip extension (0°), and ankle dorsiflexion (15°). There were bilateral finger deformations, and mild limitations of extension ROM. The dorsiflexion and palmar flexion ROM of the bilateral wrist joints were moderately limited. The extension ROM of the bilateral elbow joints were mildly limited.

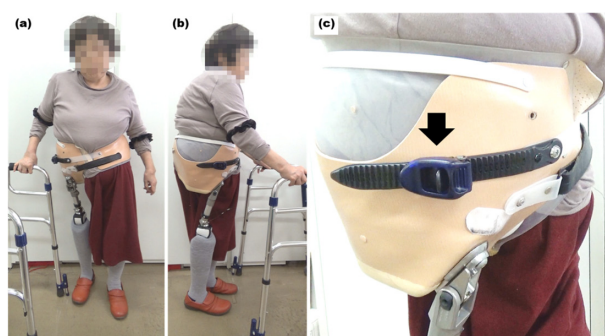
The patient felt the presence of a phantom limb, with involuntary below-the-knee flapping movement of the phantom limb. Although there was subjectively no pain (numerical rating scale (NRS): 0/10) at the surgical scar of the stump at the time of admission to our hospital, there was phantom limb pain that presented as a ‘pins and needles’ sensation (NRS: 5 to 9 out of 10). When the patient was admitted to our hospital, the pregabalin was administered 450 mg/day for phantom limb pain. The patient had daily fluctuations in joint pain due to rheumatoid arthritis at the bilateral shoulders, bilateral elbows, bilateral

**Table 1.** Changes in the Canadian Occupational Performance Measure scores over time

Problems in activities of daily living	At hospital admission			At hospital discharge			
	Importance	COPM-P	COPM-S	COPM-P		COPM-S	
Driving a car	9	1	1	5	(+4)	5	(+4)
Cooking	9	6	5	8	(+2)	8	(+3)
Going to the theater with her daughter	9	6	3	10	(+4)	10	(+7)
Bathing by herself	8	3	3	9	(+6)	9	(+6)
Going shopping by herself	7	1	1	3	(+2)	3	(+2)
Taking in the laundry	7	5	5	7	(+2)	7	(+2)
Going shopping with her husband	6	7	7	8	(+1)	8	(+1)
Mean		4.14	3.57	7.14	+3.00	7.14	+3.57

COPM-P: Canadian Occupational Performance Measure Performance subscale; COPM-S: Canadian Occupational Performance Measure Satisfaction subscale.

The values in the parentheses are the differences between the score at the time of hospital admission versus the score at hospital discharge 142 days later.



**Fig. 2.** Photographs showing a) a front and b) a sagittal view of the patient standing with the Canadian-type hip disarticulation prosthesis, and c) an enlarged view on a sagittal plane, the arrow indicating a ratcheting buckle.

fingers, and cervical spine (NRS ranging from 0 to 10 out of 10); these pains were almost nonexistent from 12 pm onwards.

The Activities of Daily Living assessment made using the Functional Independence Measure resulted in a score of 92 out of 126 points; the score was reduced by the items of self-care, transfer, and movement. Although the patient was able to turn over by herself on a bed, she needed assistance to sit up, stand up, and transfer to a bed or wheelchair. Due to instability towards the posterior direction, she required close-proximity observation when holding the end sitting posture. When she stood upright, there was a fear of sudden knee collapse, and so close-proximity observation was required, as well as grasping the handrail with both hands. She was able to walk with one-legged steps using the parallel bars for about 10 meters; however, because of the low safety and endurance it was difficult for the patient to walk with one-legged steps within the hospital. She was able to move within the hospital using a wheelchair for short distances.

An occupational therapist used the Canadian Occupational Performance Measure (COPM)<sup>12)</sup> to evaluate the patient's problems in performing the activities of daily living. The patient indicated that her main problems in activities of daily living were bathing by herself, going shopping by herself, going shopping with her husband, driving a car, cooking, taking in the laundry, and going to the theater with her daughter. In the COPM, the performance and satisfaction scores are summed and divided by the number of problems identified, giving a final total score. A change of 3 points or more in each average performance and satisfaction score is considered to be clinically significant<sup>12)</sup>. The COPM scores for the importance, performance, and the patient's satisfaction with each occupational problem are shown in Table 1 (scores range from 0 to 10).

In the patient's home environment, a large-scale house renovation was necessary to enable her to independently access the private car parking space by wheelchair from within the house. Walking was necessary for the performance of domestic housework duties and the outdoor activities that she strongly hoped to perform. Furthermore, although the back entrance of the home provided the shortest and simplest travel distance to the parking space, this involved walking up and down stairs. Therefore, it was necessary for the patient to acquire the ability to independently achieve a standing position and walk. Because the patient was able to stand and walk with one leg in the parallel bar, medical team considered that there might be possibilities of obtaining prosthetic walking. To alleviate the burden on the patient's fingers due to rheumatoid arthritis, we devised a belt-fastening method using a ratcheting buckle that is often used in ski boots, and a knee-lock release wire (Fig. 2).

This prosthesis consisted of a Canadian-type hip disarticulation prosthesis socket<sup>13</sup>) made of resin, a modular prosthetic hip joint with internal extension assist and rotation-abduction-adduction adjustable axis (7E7, Ottobock, Duderstadt, Germany), a modular monocentric locking knee joint (3R41, Ottobock), a single-axis foot (1H38, Ottobock).

Physical therapy comprised basic movement exercises, ROM exercises, muscle-strengthening exercises, sitting and standing balance exercises with and without the prosthesis, transferring with and without the prosthesis, walking with and without the prosthesis, and going up and down stairs with the prosthesis. The strength training was started with limb movements and core exercises with an open kinetic chain using weight-bands and rubbers as a protective joint load. As the patient's standing balance and ability to stand upright and maintain the standing position improved, the time spent doing standing and walking exercises was increased. To ensure that the prosthesis could swing smoothly during walking, we carried out sitting balance training and trunk muscle training, focusing on the elevation of the affected side of the pelvic area. The patient also practiced wearing and removing the prosthesis in the sitting position and the standing position. In the early stages of rehabilitation, these exercises were conducted in the afternoon when the pain had lessened. The specific problems listed in [Table 1](#) were shared within the team as the goals of rehabilitation.

## RESULTS

As soon as the practice of attaching the prosthesis began, the phantom limb pain began to reduce; phantom limb pain recurred several times, but gradually reduced by the time of discharge. The dose of pregabalin was reduced to 225 mg/day, which was half that at admission. The patient was discharged from hospital after 145 days. At the time of discharge, the physical and occupational evaluation results were as follows. Although her muscular strength had not changed regarding the MMT scores, there were improvements in muscle strength and endurance indicated by the increases in the weight-band weight, rubber hardness, and number of times the exercise sets were able to be performed in all directions of the hip and knee joints (e.g. In the knee extension exercise, the weight, the number of times and the exercise sets changed from 0.5 kg, 10 times and 1 set at admission to 3.0 kg 20 times and 3 sets at final training). There were no substantial changes in the ROM of any of the joints. The patient was able to wear the prosthesis in the sitting and the standing positions, and was also able to walk continuously for 45 meters using walker by herself at the time of discharge. The walking style improved from using walker to Lofstrand crutches for both sides at about 2 months after discharge. The rheumatoid arthritic pain in the wrist increased while the patient was in hospital, but this pain was controlled by medication, and was finally maintained at the same level as it was at the time of hospital admission. At 2 weeks after discharge, the patient was driving a car, going shopping, going to the library, using the prosthesis indoors and outdoors, and walking up and down the stairs at the back entrance of her home.

The Functional Independence Measure score at the time of discharge had improved to 108 points. The performance and satisfaction scores were improved for all problems in activities of daily living ([Table 1](#)). At discharge, the mean improvements in the performance scores (+3.00) and the satisfaction scores (+3.57) exceeded the minimal clinically important change for older adults undergoing rehabilitation<sup>12</sup>).

## DISCUSSION

The elderly HDA with rheumatoid arthritis in the present case was able to walk independently and walk in the community at the time of discharge. Fernandez and Formigo reported that 15 out of 23 people including tumour, infection, trauma and congenital malformation (87% HDA, 8.7% hemipelvectomy, 4.3% short trans-femoral amputee) had been unable to continue using Canadian prosthetic limbs<sup>7</sup>). More than half of those who can not use Canadian prosthesis died in this study<sup>7</sup>). In all cases, the cause of rejection of the prosthesis was attributed to the difficulty of ambulation, intolerance to the socket, or excessive weight of the prosthesis<sup>7</sup>). For HDAs including elderly people to acquire the ability to walk in the community, it is generally considered necessary for them to have few comorbidities, an adequate degree of physical fitness, and individual motivation<sup>2, 3, 9, 10, 14</sup>). In the present case, it was confirmed that the physical function was sufficient before fitting the prosthesis, the control of rheumatoid arthritis was comparatively good, and the motivation for reacquiring walking was very high. We set the rehabilitation goal in the consideration of the possibility of reacquiring walking with these factors. In addition, this case was able to use our novel method to attach the hip prosthesis on her own, which helped her to walk independently. Tightening the belt with the ratcheting buckle made it possible to fix the socket to the pelvis well, even with wrist and finger deformation and pain, and the handle of the knee-lock release wire was operated with the palm, rather than with the fingers. Installing these devices on the prosthetic limb effectively reduced the burden on the arthritic finger and wrist joints, and established the ability to walk independently, including performing the attachment and detachment of the prosthesis. Furthermore, performing the rehabilitation training in the afternoon when the symptoms of rheumatoid arthritis had lessened seems to have been effective in improving physical functions. The reduction of phantom limb pain may have been caused by the wearing of the hip prosthesis<sup>15, 16</sup>). From the above reason, we considered that the successful prosthetic walking resulted from good physical function in early rehabilitation, relatively controlled comorbidity, the high degree of patient motivation, appropriate rehabilitation goal setting, and sufficient communication between the patient and the medical staff.

Recent reports indicate that the proportion of HDAs who attain gait function still remains low<sup>14</sup>); however, depending on the condition and type of comorbidity, a prosthetic limb can be used in the rehabilitation of HDAs in the consideration of the

physical and psychological state of the patient. The present case highlights the fact that even HDAs with comorbidities can use prosthetic limbs to achieve clear goals.

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