

# The role of physiotherapy in the treatment of complications of hand joint rheumatoid arthritis – a case study

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## Abstract

**Background:** Rheumatoid arthritis (RA) is a chronic inflammatory systemic disease of the connective tissue and leads to dysfunction of the joints of the hand. Physiotherapy plays a key role in the treatment of RA. Physiotherapy focusing on rehabilitation of patients with arthritis depends on the biomechanical and functional state resulting from the arthritic changes. The development of a physiotherapy program aims to restore the functioning of the joint before the onset of the disease.

**Aims:** Presentation of diagnostic and therapeutic procedures in a patient in various stages of inflammatory changes of RA, over a 20-year period of progressive rheumatoid changes. Presentation of a model of physiotherapeutic improvement.

**Case report:** Case presentation of a 41-year-old patient over a 20-year period of RA, with particular emphasis on the progress of degeneration of the hand joints. The focus of this work was primarily on the observation of the effects of previous actions taken to improve the patient's functioning.

**Summary:** In the analyzed case, the progression of joint degeneration occurred without significant disturbances in basic laboratory tests of inflammatory markers. The use of all available therapy and treatment methods gives a better chance of maintaining the highest possible levels of independence and limiting the occurrence of serious dysfunctions. It also allows to objectively assess what actions should be taken in terms of effectiveness for patients with RA.

## Key words

rheumatoid arthritis (RA), hand rheumatoid arthritis, physiotherapy.

## Introduction

Rheumatoid arthritis (RA) is a chronic inflammatory systemic disease of the connective tissue and is characterized by the occurrence of symmetrical inflammation. The disease begins in the synovium of the joints, leading to the destruction of joint tissues. The inflammatory process most often occurs in and leads to dysfunction of the joints of the hand. RA is characterized by symmetric joint involvement and is one of the most common joints diseases [3]. New criteria for the classification and diagnosis of RA were proposed in 2010 by experts from the American College of Rheumatology (ACR) and the European League Against Rheumatism (EULAR) and are characterized by greater diagnostic sensitivity, which enables earlier diagnosis and implementation of effective treatment of the disease. Due to clinical significance, the new criteria included synovitis and inflammation in the foot as factors influencing the change in the clinical presentation of the disease. In early diagnosis, the importance of the number of seronegative, monoarticular, and oligoarthritic inflammations as early clinical symptoms has also increased, which has reduced the risk of false positive diagnosis in patients with self-limiting, undifferentiated arthritis [2].

In the beginning, the joints of the hands (proximal interphalangeal joints, metacarpophalangeal joints), wrist joints, and foot joints (foot interphalangeal joints, metatarsophalangeal joints) are affected. Next, other joints are affected (knee, shoulder, elbow, hip, ankle, temporomandibular joints, cervical spine, and its subsequent sections). The symptoms include soreness, swelling, symmetrical joint pain, morning stiffness lasting more than 1 hour, including difficulty moving the affected joint immediately after waking up, sensitivity to pressure, and decreased mobility in the joint. Later, joint deformations become present and include subluxations, swan-neck deformities, boutonniere fingers, and ulnar deviation of the hand [3, 4, 5].

Half of the patients develop hand symptoms within the first two years after the onset of RA and more than 90% develop these symptoms within 10 years. Therefore, complications of the joints in the hand area are the most common cause of reduced functional efficiency and determine the deterioration of the patient's quality of life [6, 7]. Early symptoms of RA affect the synovium found in the joints. Rheumatoid granulation tissue penetrates the synovium, destroying joint cartilage and bones. Pathological pannus is visible on the surface of the cartilage. Over time, joint surfaces are destroyed, joint osteoporosis and muscle atrophy occur, and periarticular structures are damaged. Simultaneously, repair processes such as fibrous and bone adhesions occur, which leads to deformation and stiffening of the joint. A typical morphological symptom in RA are rheumatoid nodules, most often appearing in the subcutaneous tissue and internal organs. Primary inflammatory changes affect the wrist joints, metacarpophalangeal and interphalangeal joints of the proximal hands, and less often the joints of the feet and large joints are affected [8].

Physiotherapy plays a key role in the treatment of RA. Physiotherapeutic methods, such as physical therapy and kinesitherapy with special methods, as well as the use of orthopedic equipment in combination with pharmacological treatment enable the achievement of positive outcomes of the therapy. This is also relevant in the case of postoperative rehabilitation, which is inevitable during the course of the disease in most cases [9].

Surgical operations play a significant role in the treatment of deformed joints by ensuring adequate correction and stabilization of the joints. They help reduce the degree of disability, leading to an improvement in quality of life. The main indicators for surgical treatment are chronic pain and loss of joint function. Most often, patients undergo surgical intervention after long-term treatment, which did not produce the desired results.

Surgical treatment includes diagnostic arthroscopy, synovectomy, arthroplasty, arthrodesis, as well as corrective, reconstructive, and stabilization procedures [10, 11].

Physiotherapy differs in rheumatic diseases due to the constantly evolving process. Each subsequent lapse of the disease significantly limits patient functioning and requires a change in the rehabilitation program [12]. Physiotherapy focusing on rehabilitation of patients with arthritis depends on the biomechanical and functional state resulting from the arthritic changes. It should start at the onset of the disease and be carried out systematically and prophylactically. It requires the cooperation of many specialists under the guidance of a rheumatologist and a medical rehabilitation specialist. The comprehensive treatment plan for patients is developed individually and includes pharmacological treatment and rehabilitation procedures. Such treatment plan is especially important in the first stage of the disease, in which no permanent arthritic changes have yet occurred. It requires frequent modifications, similarly to pharmacological treatment. The improvement plan is designed to restore the balance between declining functional capabilities and the increasing needs of the patient. The development of a physiotherapy program aims to restore the functioning of the joint before the onset of the disease and, if this is not possible, to compensate for lost functionality and develop appropriate movement patterns for the level of dysfunction [14].

## Aims

The aim of the study was to present diagnostic and therapeutic procedures in a patient at various stages of progressive rheumatoid changes. Models of physiotherapeutic rehabilitation were presented as both prophylactic, postoperative, and in the periods of exacerbation of the disease.

## Case study

The subject of the study was a 41-year-old man suffering from RA, with the first symptoms observed since 2001. The patient has a family, is physically active, and his work is primarily office-based but not strictly sedentary. He is characterized by a slim body build (182 cm, 78 kg). In the lateral position, the subject's silhouette does not deviate from the norm, apart from a visible flexion contracture in the right knee joint. In the forward position, the right hip is slightly drooped. Despite 20 years of illness, the patient's general health is good. No other chronic comorbidities have been identified, and no outward signs of a chronic condition are apparent at first contact.

The first symptoms began to appear at the end of 2001. Pain and swelling initially concerned the big toe of the right foot and the PI-PII joints of both hands, later appeared a slight effusion of the right knee joint. The diagnoses were directed towards gout, but this treatment did not bring any improvement. In February 2002, the patient began treatment at the outpatient clinic of the Silesian Rheumatology and Rehabilitation Hospital (in Polish: *Śląski Szpital Reumatologiczno-Rehabilitacyjny*) for in-depth diagnostics and change of treatment. In July 2002 he was admitted to the ward of the Silesian Rheumatology and Rehabilitation Hospital due to recurrent effusion in the right knee joint and periodic pain in the right toe (without the features of gout). Treatment included chemical synoviorthesis (MTX with corticosteroid) and comprehensive physiotherapy. A series of treatments were performed: magnetotherapy, cryotherapy, electrotherapy, laser therapy, and kinesiotherapy. The emphasis was placed on learning a proper gait, consolidating patterns of general development activities, and active weight-bearing exercises. During the hospital stay, it was recommended that a synovectomy of the right knee joint should be scheduled.

After consultation at the orthopedic outpatient clinic in September 2003, the patient was admitted to the orthopedic ward because of an effusion due to serious arthritis. A genus dex synovectomy was performed with a fragment of the synovium collected for histopathological diagnosis. Single foci of fibrinous necrosis were found. The patient underwent postoperative rehabilitation during his hospital stay, continuing the regimens presented by the physiotherapist at home. When the patient was 24 years old, he underwent further pharmacological treatment and physiotherapy during another hospital stay. Recurrent exudative arthritis of the knee did not subside, despite treatment, and in 2007 he was qualified for another surgical treatment. An arthroscopic resynovectomy of the right knee joint was performed. Subsequent stays in hospitals in 2007–2008 were related to arthritis. The progressive, treatment-resistant inflammatory process necessitated another genus dex resynovectomy in 2008. Postoperative rehabilitation lasted from the first day after surgery to 6 weeks afterward.

In 2010, the disease worsened again. Oedema of the wrist joints, MCP, single PIP, and right ankle joint occurred. Due to the progressing inflammatory changes visible on X-rays and the emerging effusion, the patient was referred for planned surgical treatment of the left hand. MCP III manus sin arthroscopic synovectomy was performed.

In 2011, a synovectomy of the MCP II joint of the right hand was performed, and in 2012 a revision of the styloid process of the left radial bone was necessary. When the patient turned 33, another hospitalization was required due to pain in the wrist joints, MCP especially II-III of both hands, II and III PIP of the left hand, I MTP of the right ankle joint with significant limitation of mobility of the left wrist, periodic pain in the right knee joint with the presence of joint cracking. The patient participated in rehabilitation aimed at restoring the mobility of both hands. In the following year, there was further damage to the wrist joints, es-

pecially to the radial wrist joint of the left hand. There was a loss of hand function, therefore endoprosthesis of the left wrist was performed. The procedure was performed in the same facility where the previous orthopedic procedures were performed. Due to severe pain in the radioulnar joint, during rehabilitation after implantation, the patient was referred for further operative treatment of the left wrist.

In 2015, resection of a fragment of the head of the left ulna was performed. The continuation of surgical treatment was a three-week hospital rehabilitation and work to obtain the greatest range of motion of the previously stiffened joint. In January 2015, the patient was involved in the biological treatment program run by the Silesian Rheumatology and Rehabilitation Hospital, which included pharmacotherapy in various configurations: monotherapy with Enbrel or Methotrexate or a combination of the two continues to this day. In the period between July 2013 and March 2016, the radiocarpal joint of the right hand was completely blocked, and the hand moved only through the second row of wrist bones, limiting the anatomical movements of the hand to several degrees of ulnar and radial deflection.

In February 2017, the 37-year-old patient was re-admitted to the rheumatology department of the Silesian Rheumatology and Rehabilitation Hospital (polyarticular pain - mainly small joints of the hands and feet). The latest surgical intervention for this patient was performed in 2019. He was referred for planned surgical treatment of the left hand due to inflammatory and destructive changes, effusion, and limitation of mobility of the third metacarpophalangeal joint during RA. In the following years, the inflammation in the wrists and small joints of the hand receded.

In June 2020, after an 11-year break, the 40-year-old patient experienced a reappearance of the effusion in the right knee and felt the pain intensify, which prevented him from performing everyday activities. Walking and driving became very diffi-

cult for the patient. MRI performed in August 2020 showed a high degree of deformation and damage to almost all joint structures. At the time of the study, the patient has been under the orthopedic, rheumatology, and nuclear medicine clinics and taking part in another biological treatment program. Active inflammation has been affecting only the right knee joint, but due to significant destructive changes, the patient is being monitored for the endoprosthesis. For the duration of the disease, the patient had been subjected to many therapies (**Table 1**) and surgical interventions (**Table 2**). Combination therapy of Remicade/Methotrexate, supplemented with a surgical procedure has been the most effective and suppressed the inflammatory process for several years. Other therapies have slowed the progression of the disease to varying degrees but have not stopped degeneration (**Figures 1 and 2**).

#### **Description of psychotherapeutic procedures**

In the initial years of the disease, the rehabilitation program was focused solely on suppressing the inflammation in the right knee joint and restoring the functionality of the lower limb by eliminating contractures and rebuilding muscle tissue. Physiotherapy was conducted during hospital stays in the years 2002-2007 and consisted of multiple stimulus procedures: magnetotherapy, laser therapy, cryotherapy, electrotherapy, ultrasound, and exercises in the field of kinesitherapy: learning the correct gait, active exercises in low gravity, general development training, quadricep, and calf muscle strengthening. Postoperative rehabilitation played an important role in the rehabilitation of the right knee joint. The patient started the postoperative exercise program the next day after surgery. After classical synovectomy, the main goal of rehabilitation was to achieve a knee flexion angle of up to 90° within 10-11 days after the surgery. The exercise regimen included alternating flexion and extension of the operated knee, stretching the joint by dorsiflexion of the foot,

and isometric training of the quadriceps muscle. The patient was able to take his first steps with two crutches the second day after the procedure and weight-bearing walking exercises lasted until 6 weeks after the surgery. After discharge from the hospital, the patient continued a series of exercises according to the patterns provided by the physiotherapist at home. The effectiveness of the rehabilitation performed is assessed as poor due to poor involvement of the patient. The contracture of the affected joint was in the characteristic's dates from the date of the first surgery. After obtaining the required angle of flexion, the patient stopped performing exercises even though the joint was functional and not yet destroyed by the inflammatory processes. Currently, the knee joint reaches a flexion angle of 90°, and performing a full extension is not possible. The rehabilitation process following arthroscopic synovectomy was significantly easier for the patient because postoperative pain levels were much lower, and the surgical procedure did not affect the joint structures to such a significant extent. The kinesitherapy program was identical to the previous rehabilitation process, but the patient was able to move on his own much earlier, and crutches were used only until the sutures were removed, 11 days after the procedure.

In the following years of the disease, the patient's physiotherapy was focused on the rehabilitation of the hand joints. During hospital stays in 2013-2017, physiotherapy was mainly focused on cryotherapy, thermal treatments (mud compresses), magnetotherapy, ultrasound, and laser therapy. Kinesitherapy consisted primarily of exercises to improve joint mobility and hand muscle strength. The training program consisted mainly of active exercises and resistance exercises at a manual table, repeating the same sequence for a period of 10 days. The program consisted of exercises focusing on strengthening the hand muscles, resistance training, and restoring the precision of the grip (**Figure 3**).

**Table 1.** Effectiveness of pharmacological treatment.

Name of the drug	Effect of treatment on the course of the disease	Remarks
Sulfasalazin + MTX	0	Therapy from the first phase of treatment
MTX + Sandimun Neoral	0	-
MTX + Arava	0	-
MTX + Remicade	2	Treatment discontinued due to remission status achieved
MTX	0	-
Enbrel	1	-
Enbrel + MTX	1	-
MTX + Metypret	1	-
MTX + Enkorton	1	-

**Abbreviations:** MTX, Methotrexate.

**Notes:** 0 – no effect on the course of the disease, progression of joint destruction; 1 – slowing of the progression of the disease, no new inflammatory lesions, reduction of external symptoms (exudates, swellings), erosions in the involved joints progress; 2 – complete stoppage of disease progression, state of remission.

**Table 2.** Effectiveness of surgical treatment (own study).

Name of treatment chronologically	Outcome according to patient's feeling	Remarks
Arthroscopic synovectomy of the right knee joint – first	0	Lowering of the flexion angle in the knee joint due to improper rehabilitation
Arthroscopic synovectomy	0	-
Synovectomy of the right knee joint – second	2	Procedure accompanied by the inclusion of treatment with Remicade combined with MTX, significant improvement in the mobility of the joint
MCPIII synovectomy – first	2	-
MCPII synovectomy	1	-
Endoprosthesis of the left wrist joint	2	-
MCPIII synovectomy – second	2	Procedure accompanied by the inclusion of treatment with Enbrel combined with MTX – significant improvement in joint mobility

**Abbreviations:** MTX, Methotrexate.

**Notes:** 0 – no effect; 1 – short-term effect; 2 – effect.



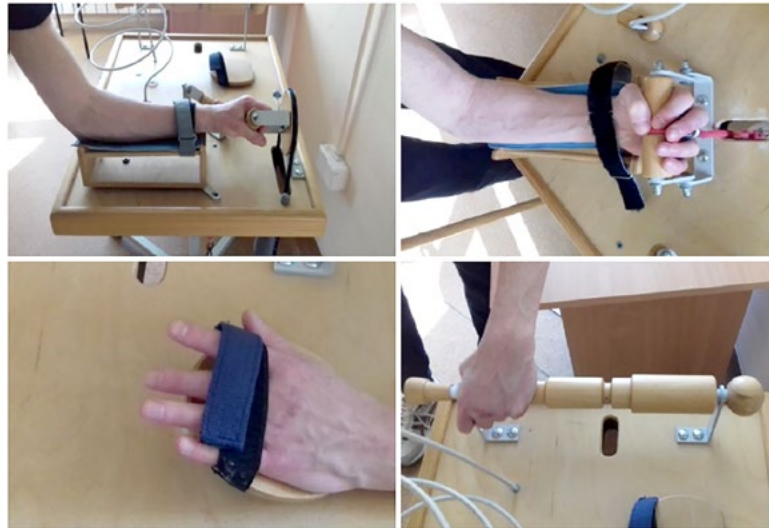
**Figure 1.** X-ray of both hands, 2013.07.13. Advanced destructive changes of the left wrist, the head of the ulnar bone, progressive narrowing of the joint space of the radial-carpal joint of the right hand, and some wrist bones. Qualification for endoprosthesis of the left wrist.



**Figure 2.** X-ray of the left hand; left: last orthopedic examination before left wrist endoprosthesis surgery, 2014.08.27; right: condition after surgery "Maestro Biomet endoprosthesis of the left wrist", 2014.10.02.

After the synovectomy of the metacarpophalangeal joints, the patient performed a series of exercises individually. Rehabilitation began on the first day after the surgery and consisted of gentle

movement of fingers, initially with a Zimmer rail, and later without a cover. The patient performed a set of exercises improving muscle strength, range of motion, and manual skills (**Figure 4**).



**Figure 3.** Hand exercises with a load.



**Figure 4.** Exercises after synovectomy of the MCP joints.



The rehabilitation period after the implantation of the left wrist lasted 12 weeks. The process, despite the patient's intense effort, did not bring the expected results. The patient's goal was to achieve a flexion angle of 45° and a dorsal flexion angle related to the gripping skills of the hand to 200 - none of the goals was achieved. Due to the pain the patient was experiencing, he had much less manual hand function for several years. In addition, the implantation procedure provided a 6-week period of joint stiffening after surgery, which made it much more difficult to achieve the intended rehabilitation goals. Physiotherapy started the day after surgery. Initially, the patient could only move his fingers in the plaster coating. The second stage, lasting from 2 to 4 weeks, was carried out at home, and consisted of active, self-assisted, and active resistance exercises. They were performed by instructions received from the hospital physiotherapist. In the next stage of home rehabilitation, the patient began to bend the wrist, which was supplemented with exercises to develop the hand muscle. The last stage of physiotherapy to improve hand function after arthroplasty was hospital rehabilitation lasting three weeks. It consisted of a combination of physiotherapy and kinesiotherapy. The following procedures were performed - cryotherapy, magnetotherapy, laser therapy, ultrasounds, and mud compresses. The patient performed exercises from the hospitalization period on the rheumatology ward with the addition of wrist relaxing massage and general hand development exercises, with manual activity training for hand grip. As a result of completed physiotherapy, the patient obtained an elbow flexion angle of up to 40° and a radial flexion angle of 5°. In general, the patient's condition with one affected joint is good, but the inflammatory process continued and for 12 months there has not been visible improvement despite regular exercise.

## Discussion

There is a great need to consider the role of early diagnosis of RA and prompt implementation of effective treatment because only such actions can lead to remission or low activity of the inflammatory process. A good response to treatment is a derivative of the amount of time from the onset of the disease. Based on clinical observations, the concept of the therapeutic window (the initial phase of the disease) has been proposed. Early treatment significantly reduces the health consequences of the disease and often leads to long-term remission. This procedure includes a change in classification criteria, which significantly increases the sensitivity of the diagnostic process and helps identify those patients who may have had a long-term delay in the implementation of effective treatment [12]. In the early diagnosis of rheumatic diseases, special attention is paid to indicators of inflammation expressed by the sedimentation rate of red blood cells (ESR) and the increased concentration of the CRP protein [12, 13]. Kwiatkowska et al. [13] drew attention to the problem of a "good" early diagnosis. In the summary of the study, the authors propose several solutions enabling the creation of the so-called "fast track", i.e., a group of mechanisms that shorten to a minimum (2-3 weeks) the time from the patient's first contact with the doctor until the implementation of the appropriate treatment, emphasizing the importance of quick diagnostics, and above all accurately ordered laboratory and imaging tests that enable early detection of RA, regardless of their financial value. The conclusions were supported in the work by calculations comparing the costs of diagnostics with the amount of money related to a possible hospitalization of a patient. Many researchers and practitioners draw attention to the role of physiotherapy in the treatment of RA as a process that helps combat pain and inflammation,

positively affects physical fitness by increasing muscle strength and the range of motion in the joints, restores physiological movement stereotypes, and develops proper compensation. It also contributes to the prevention or minimization of joint deformities, the improvement of gait efficiency and function of the upper extremities, and the improvement of independent activity in the daily and professional life of patients [14].

Książopolska-Orłowska [11] also draws attention to the role and experience of the physiotherapist in the rehabilitation process. Planning a comprehensive rehabilitation protocol requires knowledge of the patient's general condition, mechanics and pathomechanics of the musculoskeletal system, compensatory mechanisms, as well as a skillful selection of resources available for modern rehabilitation. Exercises that are too intensive or are conducted in incorrect body positions may cause deficits to worsen due to tearing tendons, ligaments, or joint cartilage damage, joint capsule, or muscles. Each method of physiotherapy has indications and contraindications for its use. Treatment of chronic, inflammatory, immune-mediated connective tissue diseases, involving the musculoskeletal system in both adults and children, is long-term, multidirectional, and must be carried out systematically. Rehabilitation of patients with RA is part of a comprehensive treatment for the rest of their lives. It is especially important in the

first stage of the disease, in which no permanent changes have yet occurred. It requires both multiple modifications ordered and under the supervision of a specialist in medical rehabilitation, as well as pharmacological treatment ordered and under the supervision of a rheumatology specialist [11].

## Summary

In the case under study, we are dealing with a patient suffering from RA with a very unusual course, both at the onset of the disease and at its future course. Significant diagnostic parameters, such as inflammatory markers, i.e., sedimentation rate of red blood cells (ESR) and increased concentration of CRP protein, were not suggestive of RA in this patient. X-ray examinations of the feet and hands and the inflammatory process of the knee joint (clear visible effusion) performed on the patient in the initial stage of diagnosis were not effective diagnostic tools. The radiological examination did not reveal inflammatory changes suggestive of RA. Analysis of treatment methods performed indicates that only the use of all available methods simultaneously enabled the effective suppression of the inflammatory process in the affected joint. Rehabilitation of the hand after wrist arthroplasty in the course of RA is a long-term process, and the resulting improvement in hand mobility may be minimal.

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