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Case Study of Physiotherapy Treatment of a Patient with

Rheumatoid Arthritis

Bachelor Thesis

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Declaration

I hereby declare that the following thesis case study was written by me, together with all the methods and physiotherapeutic procedures, based on the knowledge I gained during my studies at Charles University Faculty of Sports Education in the last three years.

My clinical work placement took place at Revmatologický ústav, Prague, Czechia, under the supervision and guidance of Mgr. Markéta Mikulášová.

Declaration for the assurance that no invasive methods were used during the sessions and practical approach, furthermore the patient was aware of the therapy that was given.

Prague, 2021 Silia Ioannidou

Acknowledgments

I would like to express my gratitude to my bachelor's thesis supervisor, Mgr. Ilona Kučerová, for her great leadership and time spent advising and consulting me. In addition, I would like to thank my patient A.D for her patience, cooperation, and positive approach to the rehabilitation.

However, I would like also to thank all my teachers in UK FTVS that they provided me with their best knowledge in practice and theory during my studies, but also for helping me when needed.

Last but not least, I would love to thank my family and friends for being there for me during these whole years.

Abstract

Author: Silia Ioannidou

Title: Case Study of Physiotherapy Treatment of a Patient with Rheumatoid Arthritis

Goals: The purpose of this thesis is to provide informative content about the risks, pathology, and general information about rheumatoid arthritis disease, as well as to analyze the diagnosis and treatment of a patient diagnosed with rheumatoid arthritis. Physiotherapeutic methods and techniques were applied to the patient in 8 sessions, with the main goal is to reach the optimal quality of life of the patient without any further chronic complications.

Methods: This thesis is divided into two main parts. The first part provides information about the general overview of rheumatoid arthritis disease. The second part presents the case study analysis of a patient diagnosed with rheumatoid arthritis. It contains the initial kinesiological examination, short and long-term therapy goals, 8 detailed day-to-day therapies, and finally conclusion and effectiveness of the therapy. Unfortunately, I was not able to perform the final kinesiological examination with my patient because she was tested positive with Covid-19. Nevertheless, I was able to observe the effectiveness of therapy, posture, gait, and symptoms in the last 2 sessions.

The main aim was to prevent any further complications and progressions, achieve better quality in the activities of daily life and reduce the symptoms and pain. No invasive methods were used.

Results: The effectiveness of therapy was significant as the patient day by day was feeling better in physical and mental health. The swelling was reduced, there is a greater ROM and pain is not there anymore. Posture, balance, and gait showed a significant change for more optimal patterns.

Keywords: Rheumatoid arthritis, prevention, swelling, ADL, posture, gait, upper extremities, lower extremities, hands, feet, range of motion, physical therapy.

Abstraktní

Autor: Silia Ioannidou

Název: Případová studie fyzioterapeutické léčby pacienta s revmatoidní artritidou

Cíle: Účelem této práce je poskytnout informativní obsah o rizicích, patologii a obecných informacích o onemocnění revmatoidní artritidou, jakož i analyzovat diagnózu a léčbu pacienta s diagnostikovanou revmatoidní artritidou. Fyzioterapeutické metody a techniky byly aplikovány na pacienta na 8 sezeních, přičemž hlavním cílem je dosáhnout optimální kvality života pacienta bez dalších chronických komplikací.

Metody: Tato práce je rozdělena do dvou hlavních částí. První část poskytuje informace o obecném přehledu o revmatoidní artritidě. Druhá část představuje analýzu případové studie pacienta s diagnostikovanou revmatoidní artritidou. Obsahuje počáteční kineziologické vyšetření, krátkodobé a dlouhodobé terapeutické cíle, 8 podrobných každodenních terapií a nakonec závěr a účinnost terapie. Bohužel jsem nemohla provést závěrečné kineziologické vyšetření u mé pacientky, protože byla pozitivně testována pomocí Covid-19. Přesto jsem byla schopna sledovat účinnost terapie, držení těla, chůzi a příznaky na posledních 2 sezeních. Hlavním cílem bylo zabránit dalším komplikacím a progresi, dosáhnout lepší kvality činností každodenního života a snížit příznaky a bolest. Nebyly použity žádné invazivní metody.

Výsledky: Účinnost terapie byla významná, protože pacient se každý den cítil lépe ve fyzickém i duševním zdraví. Otok byl snížen, je větší ROM a bolest už není. Postoj, rovnováha a chůze vykázaly významnou změnu pro optimálnější vzorce.

Klíčová slova: Revmatoidní artritida, prevence, otoky, ADL, držení těla, chůze, horní končetiny, dolní končetiny, ruce, nohy, rozsah pohybu, fyzikální terapie.

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1. Introduction

Rheumatoid arthritis is a chronic (long-term) inflammation disease of the joints. It is an autoimmune disorder and a major cause of disability affecting 1 per cent of the population. This disease is an outcome from changes in the joints such as anatomical and functional.

It is a multi-arthritis that means it affects many joints. Small joints, such as the fingers and toes, but also large joints, such as the knees, wrists and elbows. A feature of rheumatoid arthritis is that it affronts symmetrically. It can appear in a few joints (eg. 2-6 joints) or more joints.

The main clinical signs of this disease are pain, stiffness (mostly in the morning hours) , fatigue and swelling of the joints, furthermore limitation of the physiological range of motion. Later on, the impact of these changes can also affect other body parts, such as the soft tissues of the body, like skin, or organs, even the lungs resulting in a faulty breathing stereotype. Consequently it can cause great difficulties in daily life. (4)

However, with the right pharmacological treatment, alongside with rheumatoid comprehensive therapy can influence remarkably the quality of life, the daily activities of the patient, and that will help gradually the psychology and self esteem of the patient, to have a standard social ,occupational and educational living.

The main aim of this thesis is to concentrate on the treatment and rehabilitation of a patient after diagnosed with rheumatoid arthritis. The case study of the patient diagnosed with Rheumatoid arthritis took place at REV Revmatologický ústav (Rheumatology Institute) in Prague, Czech Republic, for two weeks, 10 working days, from the 18th of January until the 29th of January 2021, and supervised by Mgr. Markéta Mikulášová. Treatment was mostly focused on the prevention of further limitations, reduce pain in the joints, improve the gait, posture and balance with special exercises and with assurance of prevention of fall.

As my patient was tested positive with Covid-19 unfortunately I was not able to accomplish the final kinesiological examination, either way, the therapy was effective as I observed improvement of posture and gait during the last two sessions, and according to my patient the pain was significantly reduced.

2. General Part

2.1 Features of rheumatoid arthritis

The hallmark feature of rheumatoid arthritis (RA) is persistent symmetric polyarthritis (synovitis) that affects the hands and feet, although any joint lined by a synovial membrane may be involved. Chronic RA mostly results in the progressive development of various degrees of joint destruction, deformity, and a significant decline in functional status. Most commonly affected joints are DIP, MCP and MCP. Involvement of organs such as the skin, heart, lungs, and eyes can also be significant. Despite the joints are almost always the main focus of RA, other organ systems may also be involved. Extra-articular manifestations of RA occur most often in seropositive patients with more severe joint disease, which may lead to cardiopulmonary disease, eye disease, Sjogren's Syndrome etc.

Main symptoms can be pain, stiffness, swelling of joints, limited range of movement which results in a complicated quality of life. (5) Patients with RA can express that they feel fatigue, morning stiffness, also difficulty performing activities of daily living (ADLs), such as dressing, standing, walking, personal hygiene, or use of their hands. In addition to articular degeneration, other symptoms (eg, fatigue, tiredness, malaise, morning stiffness, weight loss, and low-grade fever) can be present. These symptoms and clinical signs are the classification criteria for RA. (Fig.1)

A classic case of RA begins quietly, with the slow development of clinical signs and symptoms over weeks to months.

TABLE 1: 1987 ACR Classification Criteria For RA

1987 Classification Criteria	
Criteria	1. Morning stiffness (at least one hour) 2. Arthritis in three or more joint areas 3. Arthritis of hand joints (≥ 1 swollen joints) 4. Symmetric arthritis 5. Rheumatoid nodules 6. Serum RF 7. Radiographic changes (erosions) on X-rays of hands
Applicable for	All arthritis patients
Results in	Classification of RA (yes/no)
Positive in case	Four of the seven criteria must be present. Criteria one through four must have been present for at least six weeks.
Test characteristics	Sensitivity of 79%–80% and specificity of 90%–93% for established RA. Sensitivity of 77%–80% and specificity of 33%–77% for early RA.

Figure 1. Classification and criteria for RA

RA affects the synovial tissue surrounding the joints. As the disease advances joint tissue may become permanently damaged.

Osteoarthritis (OA) is often confused with RA. In OA, the protective cartilage gradually waste and the bones begin to rub against each other (Fig.2). This wear can result from repetitive movements, for example in sports, that place pressure on the joints.

On the other hand RA it is an autoimmune disease which appears when a person's immune system falsely attacks healthy tissues in the joints.

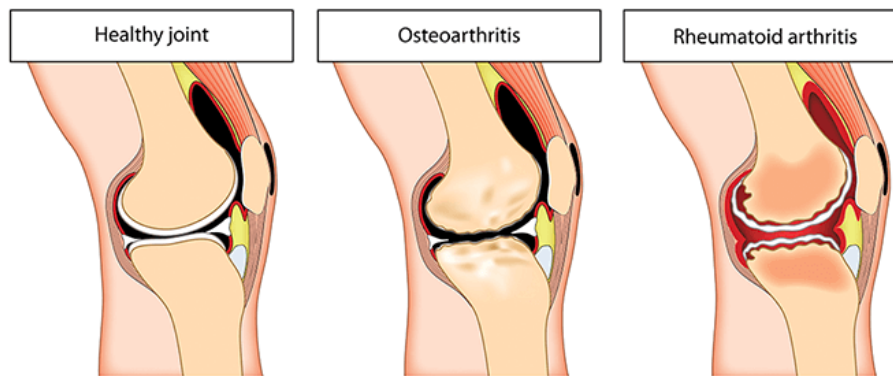


Figure 2: Healthy knee joint compared to Osteoarthritis and Rheumatoid arthritis

2.2 Pathology and Etiopathogenesis of RA

Rheumatoid arthritis (RA) is a disease of unknown origin, which is characterised by inflammatory changes of the synovial tissue of joints, cartilage and bone, less frequently, of extra-articular sites. Etiopathogenesis can be depended on genetic susceptibility, immunological reaction mostly involving a foreign antigen focused on synovial tissue and environmental factors, for example cigarette smoking and dust exposure.

There is an important interaction between elements of the adaptive immune system and the innate immune system. Malformation in the cellular and humoral immune response lead to the incident of autoantibodies, specially rheumatoid factors (RF) and antibodies against post-translationally modified proteins (Anti-modified protein antibodies (AMPA) that include antibodies against various modifications such as citrullination (ACPA)) , carbamylation (aCarP) and acetylation(AAPA) as well as the transmigration of T and B- lymphocytes into the synovium. (11;15)

This disease is characterised by lasting articular inflammation and joint damage defined by the proliferation of synovial tissue fibroblasts, along with T and B

lymphocytes, neutrophils and monocytes transporting into the synovium. The Inflammation causes the synovium to hypertrophy-Synovitis, and this results in the formation of an abnormal tissue called “Synovial Pannus”, which breaks and destroys articular structures.(Fig.3) Cells in the RA pannus states pro-inflammatory cytokines, chemokines and matrix metalloproteinases leading to progressive cartilage and bone destruction.

In accordance with researches, it was accepted decades ago that certain HLA-DRB1 alleles are associated with susceptibility to RA.

The synovial membrane is made made up by cells known as fibroblast- like synoviocytes (FLS).

These are very important in the pathogenesis of RA. Macrophages fundamentally begin to secrete cytokines such as TNF- α , IL-1, IL-6 which leads to inflammation.

These cytokines stimulate the FLS, and they become activated and begin to proliferate, stimulating the RANKL expression and together with cytokines stimulate osteoclast activity which leads to bone erosion. FLS secrete proteases causing the cartilage to break down.

Another interesting characteristic of the FLS when they are activated, they can migrate from joint to joint, and further they can migrate from hand joint of one side to the hand joint of the other and that’s the feature of symmetrical arthritis in RA. T-cells are also in the synovium which promote inflammation and they secrete IL-17 which promotes macrophages activity and stimulate FLS. Plasma cells are found in this area also, and they essentially assist in the inflammation through cytokines as well as through antibodies.(Fig.3)

In the synovial fluid, neutrophils produce proteases and reactive oxygen species which cause bone and cartilage degradation, contributing to the inflammation. In the synovial fluid we also find immune complexes which is a feature of RA, antibodies that bind to one another and they promote inflammation. Angiogenesis also is created and the cytokines produced by these cells help increase the vascular permeability and express adhesion molecules. This allows the immune cells to migrate into the joints. (8)

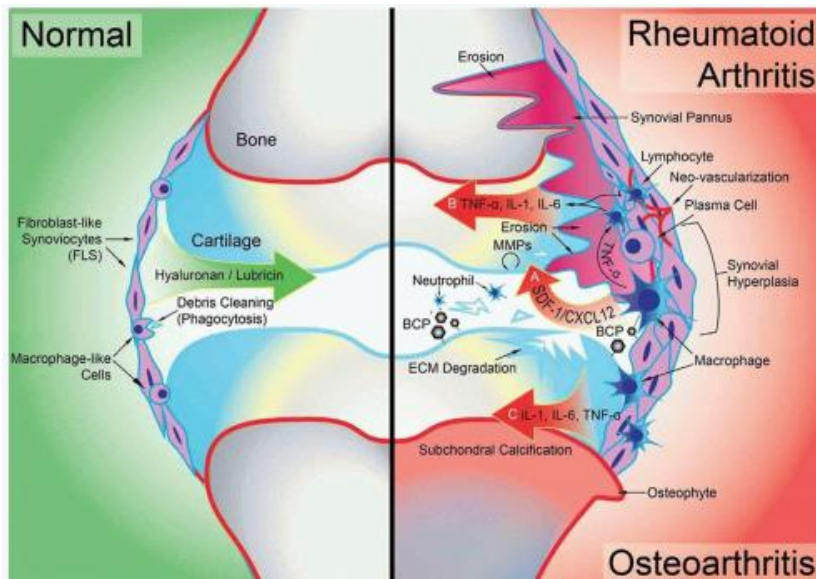


Figure 3: Diagram of physiological synovium and synovial changes under pathological conditions of rheumatoid arthritis (RA) and osteoarthritis (OA)

2.3 Stages of RA

Stage 1 - pre-clinical

- Before RA becomes clinically manifested, the immune pathology already begins.
- Initial Inflammation in the joint capsule and swelling of synovial tissue (synovitis)
- Symptoms can be joint pain, swelling and stiffness.
- X-rays don't show any changes of bone or cartilage destruction yet.

Stage 2:

- The inflammation of the synovial tissue becomes severe enough that causes cartilage damage.
- In this stage the symptoms can be loss of mobility, decreased range of motion in the joints is now more regular.
- Pannus is created. It is a moderate stage of rheumatoid arthritis.

Stage 3:

- Destruction of bones and cartilage.
- Pain is increased as well as the swelling is now greater.
- Range of motion is limited and muscle strength is reduced.
- Some slight physical deformities of the joint may start to develop.(Fibrous ankylosis)

Stage 4:

- End-stage of RA.
- No longer inflammation in the joint. Joints no longer work physiologically
- Articular destruction, capsular stretching and tendon rupture leads to progressive instability and deformity of the joints.(Bony ankylosis)

Stages of Rheumatoid Arthritis

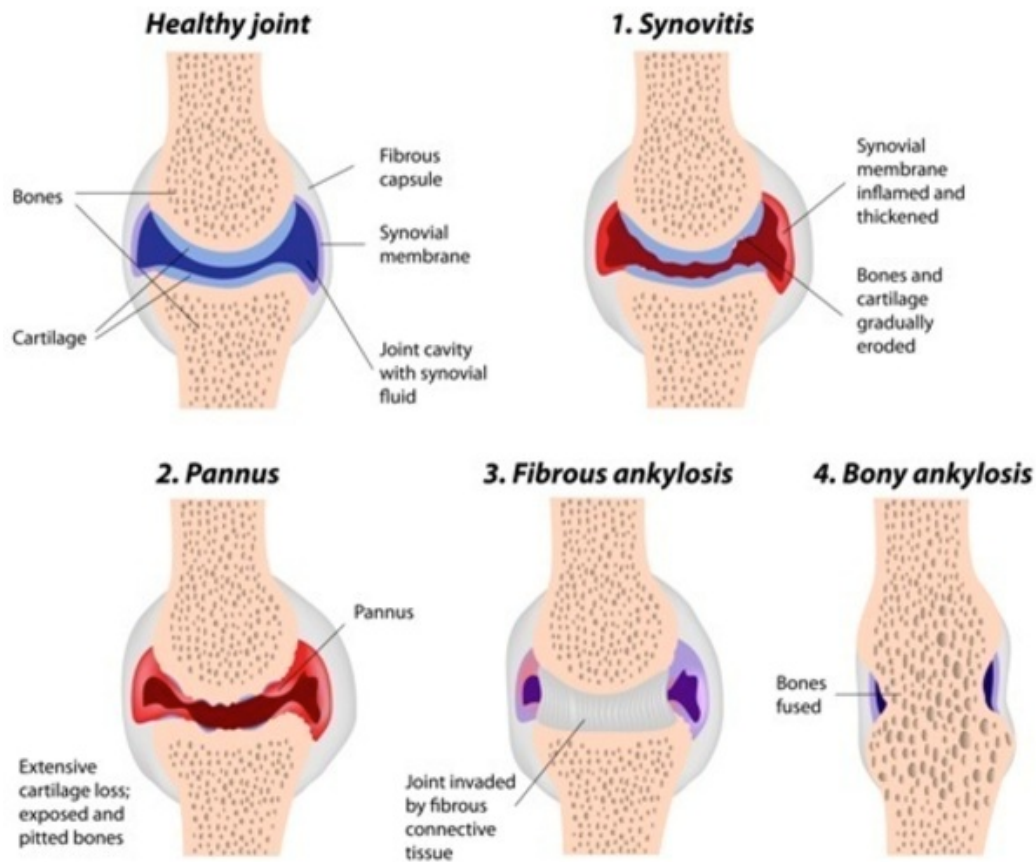


Figure 4: Stages of RA

2.4 Epidemiology and risk factors

Rheumatoid arthritis is a common disease that affects men and women. Only 30% of the causes of RA can be associated to genetic factors, thus the rest remain unexplained. The prevalence of RA is relatively constant in many populations at 0.5–1.0% with a woman to man ratio of 3:1. It's four to five times higher in women under 50 years, but after 60 years the ratio changes more or less 2 to 1. (23;24)

The risk factors of RA can be cigarette smoking, results of studies point out that smoking can change the body's immune response and it can be one of the most important risk factors for the development and severity of RA. Other risk factors can be the female gender, hormones (estrogen, testosterone, menopause), the age (usually around 60 years old), stress can worsen the symptoms, obesity, previous infection can also trigger RA, Gut bacteria, presence of the HLA-DRB1 with expression of shared epitope. Generally a major role has the lifestyle of the person, the diet and generally the habits of a person's life. (13;25)

2.5 Rheumatoid Arthritis progression and manifestation

RA in the first stages, don't show any significant changes or deformities of the joints. In later stages, different progressions can occur such as:

- Swan neck deformity of the fingers: This describes hyperextension at the PIP joint together with flexion of DIP joint.

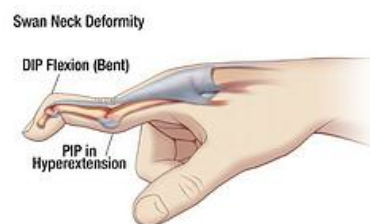


Figure 5: Swan neck deformity of the index finger in RA (DIP flexion and PIP extension)

- Boutonniere deformity of the fingers (Fig.5): This describes hyperextension at the DIP joint together with flexion of PIP joint.



Figure 6: Boutonniere deformity of finger in RA (DIP hyperextension and PIP flexion)

- Ulnar deviation: Hands and fingers deviate medially (towards ulna)

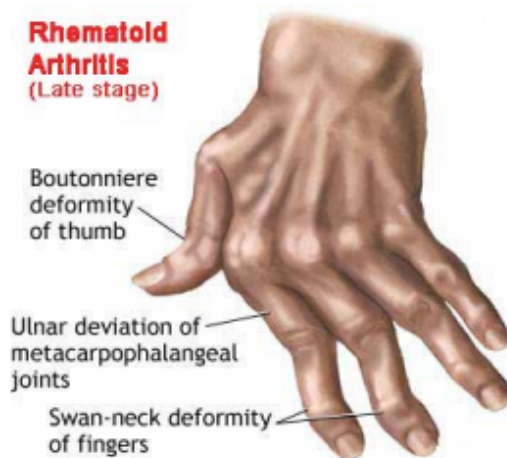


Figure 7: Ulnar deviation and hand deformities in RA

- Shoulder: RA frequently involves the shoulder illustrated by tenderness, limited movement and pain during the night. Originally swelling appears anteriorly but it might be difficult to detect. Secondary to synovitis rotator cuff degeneration, can limit rotation and abduction. Glenohumeral tear leads in pain with the movement and at rest, typically leads to acutely restricted motion or “frozen shoulder syndrome.”

- Elbow: RA in the elbow can be very uncomfortable, and it may affect daily tasks, such as manipulating objects. Elbow complication is regularly detected by palpable synovial proliferation at the radio-humeral joint and usually it's accompanied by a flexion deformity. There is usually intervention of the olecranon bursa, as there are rheumatoid nodules in the bursa and longways the extensor surface of the ulna. Moreover, severe swelling can also lead to nerve compression, and this may have as a symptom a feeling of pins and needles sensation, even partial or complete numbness in the elbow and distal arm.

- Hip: As hip is one of the largest joints of the body, developing RA in this joint can affect majorly the mobility of the patient. A standard symptom is the pain of the hips during standing or walking limiting the range of movement and changing the weight distribution and further changing the centre of gravity of the human body, causing difficulty of ADL. The pain is usually dull, aching and is located near the groin, radiating further to the thigh. Finally coxarthrosis is one of the most common problems in a patient with RA and often undergo surgery of total hip replacement.

- Knee: The knee joint is important for both stability and mobility. Symptoms of RA in the knee can be the same like the other joints (pain, swelling, warmth etc.) but also it can lead to the formation of pseudo thrombosis. Also Baker's cyst may occur which can be palpable behind the knee, on the popliteal fossa, and it appears in-between the tendons of semimembranosus muscles and the medial head of the gastrocnemius.

- Foot and toes:
- Bunion: It is a bony lump that forms on the joint at the base of the big toe. It occurs when some of the bones in the front part of the foot are removed out of place, leading the big toe to push against the next toe and the joint at the base of the big toe to stick out.
- Hammer toe: The toes are permanently bent and curled under, like a claw. It is common for formation of hammertoe deformity in the second toe in people who have a bunion in the big toe.
- Heel pain: This pain in RA patients can lead to loss of stability and balance.

All these deformities can lead to flat foot - flattening of the foot arch and this plays a major role in the loss of balance leading to instability of the ankle and further affects the whole body.

RA can also lead to extra-articular manifestations. Different studies show that RA might be most common in females but extra-articular manifestations are common in males. Furthermore, in RA extra-articular organ involvement is more frequently seen in patients with severe, active disease and is associated with increased mortality

-Skin: The most frequent skin manifestations are the rheumatoid nodules. They occur principally in autoantibody-positive RA patients and in the early stages of RA provide a risk to severe

extra-articular manifestations. Other manifestations that can influence the skin are splinter haemorrhages, periungual infarcts, leg ulcers, digital gangrene and painful ulcerations. Skin ulcers can occur mostly in the body parts that are exposed to pressure while bed immobilisation such as heels, elbows and so on. Skin manifestations are often associated with episcleritis, pleural and pericardial effusions.

-Eyes: The prevalent is keratoconjunctivitis sicca, which affects at least 10% of patients, and it comes often with xerostomia in a secondary Sjögren's syndrome. Episcleritis or scleritis can occur, episcleritis which is the inflammation of the layer superficial to the sclera is not so common. On the other hand scleritis which is more aggressive and it is an acute painful inflammation of sclera.

2.6 Diagnostic methods and physical examination in rheumatoid arthritis

1. Laboratory Testing:

- Rheumatoid factor (RF) – significant concentrations of RF can be present in most people (about 80%) with RA, however, it can also be present in people with other diseases and in a modicum percentage of healthy people. This test can be useful to confirm the diagnosis if it is positive in someone with symptoms of RA.

- Cyclic citrullinated peptide (CCP) antibody – Can be used for diagnosis of RA and specifically early in the disease, even before symptoms come out. (21)

- Antinuclear antibody (ANA) – ANA laboratory test can be used to screen for certain autoimmune disorders, sometimes including RA, but is mostly used for diagnosis of systemic lupus erythematosus (SLE).

- Erythrocyte sedimentation rate (ESR) – It shows the existence of inflammation in the body and the action and progression of the disease. This test not only helps to diagnose RA but also to monitor the condition of the patient. ESR is increased in RA but not in osteoarthritis.

- C-reactive protein (CRP) – It indicates the inflammation in the body and tests the activity of the disease. It also can be used to diagnose RA and to evaluate the condition. CRP is increased in RA but not in osteoarthritis.

- Complete blood count (CBC) –This test is a full blood test to evaluate the patient’s leukocytes and erythrocytes as well as hemoglobin to monitor for anemia.

- Comprehensive metabolic panel (CMP) – This group of tests are used to monitor kidney and liver function.

- Uric acid – Uric acid is a waste product that tends to be present in high amounts when a person has gout, which is another form of inflammatory arthritis.

2) Imaging Tests:

- **X-ray** – It can monitor joint damage but not in the early stages of the RA where it doesn’t show any significant changes. In the early stages, X-rays can detect soft tissue swelling or joint effusion.

- **Ultrasound and MRI** – Ultrasound and MRI can be used to detect changes in the joints earlier in the disease. These imaging methods are more precise especially during the first stages of RA as they can detect thickening of synovial tissues (synovitis) or cysts which can lead to swelling of bone marrow that prognosticates bone erosion in later stages. (18)

3)Physical examination:

Patients diagnosed with rheumatoid arthritis mostly appear fatigued. A doctor or physical therapist can evaluate and observe the overall condition of the patient. Some points to observe can be:

- Vital signs - like a low-grade fever
- Skin - Observe rheumatoid nodule found over bony prominences, erythema, atrophy of digital skin, diffuse thinning, beading on the nails, etc.
- Eyes - Dry eyes, scleritis or scleromalacia
- Abdomen - with palpation observation of hepatomegaly or splenomegaly
- Extremities - Inspection of redness and swelling especially in feet and hands. With palpation, a physician can feel tenderness, pain on movement, or decreased range of movement.

2.7 Therapy and Treatment of Rheumatoid Arthritis

Despite the fact that in rheumatoid arthritis there is no specific therapy, early treatment may decrease the joint damage, prevent reduced ROM, stop the inflammation or reduce it to the lowest possible level, relieve the symptoms like pain, prevent joint and organ damage, improve function and overall well-being and lastly and more importantly prevent long-term complications and other symptoms. The goals for the treatment can be achieved either with medication, physical therapy, change of lifestyle, supportive treatments, or surgery. (9;17;26)

- Disease-Modifying anti-rheumatic drugs (DMARDs)

These medicaments can reduce and relieve the symptoms of RA and also slow down the progression.

DMARDs can work in a way, where they block the effects of the released chemicals in the human body when the immune system attacks the joints. Some of the

DMARDs can be Methotrexate, Leflunomide, Hydroxychloroquine, and Sulfasalazine.

Methotrexate is generally one of the first medicaments used for rheumatoid arthritis, frequently with another DMARD and a short course of corticosteroids in order to relieve pain.

- Biological Treatments

Etanercept and infliximab are a brand new form for the treatment of RA.

If the treatment only with DMARDs doesn't work then a combination of biological treatment together with DMARDs is given. (16)

These biological treatments are often given by injection and work with the purpose to block specific chemicals found in blood, and stop them from activating the immune system to attack the joints.

- Non-steroidal anti-inflammatory drugs (NSAIDs)

These drugs can be used to reduce inflammation and pain, however, they do not slow the progression of RA. NSAIDs are Ibuprofen and Naproxen. These drugs can have some risks as they can raise blood pressure and they are strong medicaments that can irritate the patient's stomach and this can cause stomach ulcers and bleed.

- Steroids

It is known that steroids are strong medicaments that help to ease pain, inflammation, and stiffness. These medicaments can be administered either with a tablet, or an injection into a painful joint or muscle. They work as a short-term pain relief until other medicaments, like DMARDs, take effect.

- Surgical- Operational treatment

If the symptoms of swelling, inflammation and joint damage, and pain are already severe and non-bearable then surgical treatment for joint replacement is needed. This approach can influence and improve in further stages the mobility and pain.

There are different approaches depending on the joint type and the location, for example, the ankle joint is not responding well in a joint replacement but it can respond better with a surgery called joint fusion.

- Physical and Occupational Therapy

Early Physical and Occupational therapy can help the patient's quality of life. The main goals of a physical or occupational therapist are to improve the ADL and prevent any further limitations in mobility, reduce the pain, and improve the overall fitness and muscle strength of a patient. In PT, patients can learn how to use heat and cold to help them with the pain and swelling of joints, as well as improve the grasping and manipulation of objects as the first joints to be affected are in the hands and feet. (1;7)

Each individual patient talks and agrees with their physical therapist about the goals that they want to achieve especially during the rehabilitation in the hospital. According to the initial kinesiological examination each patient plans the short-term goals together with their physical therapist. Some of the main short-term goals are :

- Prevent any further limitations in the physiological range of motion of the joints
- Reduce the pain and swelling
- Improve muscle strength
- Relax and stretch the hypertonic muscles
- Improve the posture during sitting, standing, or walking
- Improve the grasping (depending on the goals for each individual)
- Improve balance and stability (prevention of fall)
- Improve ADL

Some physical therapy techniques that are mostly used in people diagnosed with RA can be, joint play manual therapy, PIR approach for relaxation of the muscles, STT to relax and improve the mobility of soft tissues and fascia, strengthening exercises to increase

the muscle strength, balance exercises, posture, and gait exercises together with a correct pattern of breathing, cold applications to reduce swelling and generally exercises to improve the ROM of joints that are already limited.

The long-term goals for a patient with RA can be active, active-assistive, active against resistance movements. Also walking improvement, walking up the stairs and down, strengthening of the deep stabilization system with aids like medicine ball (3-month old position)

2.7.1 Physiotherapy Modalities

Some of the physiotherapy modalities can be cold/hot applications, electrical stimulation, and hydrotherapy, and most often they are used based on the individual experience and goals.

Cold/Hot applications

Cold and hot applications can show a notable change in swelling. Cold applications are used often in the acute stage of RA and hot applications can be used in the chronic stages. The goal of these hot applications is to achieve analgesic effect, elasticity, and flexibility of structures and reduce muscle spasms. For thermotherapy, there are various approaches that we can use such as a hot-pack application on the skin, infrared radiation, fluidotherapy, paraffin, or hydrotherapy. It is ideal to use heat before exercises with the patient to achieve maximum benefit.

Even though heat is a very important therapy, caution is required in patients with sensory deficiency as long as they may not feel the heat and lead to a burn of the skin and tissues.

Cold therapy is ideal for joints that are active and hyperthermia may occur in unpleasant ways. Some cold applications can be cold-packs, ice, cryotherapy or nitrogen spray.

Electrical stimulation

A typical method used for patients with RA is transcutaneous electrical nerve stimulation (TENS) therapy.

Various studies have reported a decrease in pain using TENS once a week for 3 weeks as well as a significant increase in hand grasping strength after a daily session of 15 minutes of TENS. Levy and colleagues observed reduction of synovial fluid and inflammatory exudate following TENS application in acute arthritis and suggested that pain relief may be partially explained by this effect. (Vural Kavuncu, 2021)

Hydrotherapy

Hydrotherapy can be used also as one type of water exercise that can help and improve strength, flexibility, aerobic conditioning, and range of motion. Exercising in water means a low impact on the joints as long as the gravity is not the same and the pressure in the joints is much less. During a session of hydrotherapy, the water must be warm and not too deep for the individuals. Some other exercises in the pool can be for example a stationary bicycle or aerobic exercises such as water walking, hip kicks, forward lunges, etc. under the supervision of a physiotherapist. Hydrotherapy has more benefits in the health of the patient as for example to ease anxiety, depression, and pain, improve circulation and promote relaxation as well as reduce joint tenderness, joint pain, and tension. (2)

Case study

3.1 Methodology

My clinical work placement was done at the Institute of Rheumatology in Prague from the 18th of January until the 29th of January 2021. My practice was supervised by Mgr. Markéta Mikulášová. 8 daily sessions were done with my patient which was diagnosed with rheumatoid arthritis.

The sessions took place in the inpatient rehabilitation department, usually every day after breakfast. The initial kinesiology examination was done on the first session with my patient. Therapies and exercising took place in the same department, as the room was equipped with all the essentials needed for the sessions. The therapeutic procedures included soft tissue techniques (STT), PIR approach acc. to professor Lewit, relaxation techniques, breathing exercises during balance and posture exercises using unstable surfaces, bands, bosu, medicine ball, etc. always with the prevention of fall. Improvement of the gait and improvement of muscle imbalances using muscle strengthening exercises especially for the grip.

Unfortunately due to the Covid-19 pandemic, I was not able to perform the final kinesiological examination as my patient was tested positive after the 8th session. Nevertheless, I was able to observe the therapy's effectiveness throughout our sessions and during her entrance or exit of the rehabilitation department.

My patient was informed and agreed to take part in this case study, as she signed the agreement document that approved by the Ethics Committee of the Faculty of Physical Education and Sport at Charles University.

3.2 Anamnesis

Examined person: A.D

Year of birth: 1941

Diagnosis: Rheumatoid Arthritis

Status Praesens:

Objectively:

- **Weight:** 80kg
- **Height:** 160cm
- **BMI:** 31,2
- **Blood Pressure:** 106/66 mmHg
- **Pain Level:** 7/10
- **Somatotype:** Endomorph
- **Dominant limb:** Right side
- **Assistive devices:** None
- **Glasses:** Only when she is reading

Subjectively:

Chief complain: The patient complains for pain on the right knee and swelling, after she had total knee replacement. Also she complains for pain of the left shoulder, pain of joints of the hands and swelling. Morning stiffness for approx. 15 minutes after she wakes up.

Diagnosis: Seronegative Rheumatoid arthritis was diagnosed in 1989. Arterial hypertension (2002) monitored, and bilateral Flebothrombosis of saphenous vein (2014) , which is temporarily anticoagulated. Osteoporosis, denosumab therapy. Dyslipidemia.

Surgical Anamnesis: Elbow surgery after fall injury on the left side, followed by extraction of osteosynthetic material. Left coxarthrosis and gonarthrosis, total hip replacement in 2013 and knee replacement in 2016.

Medical/ pharmacological Anamnesis: Therapy with glucosteroids (prednisone) in high dose, further distraction added to the medication methotrexate. ACE1 and calcium channel blocker therapy and blood pressure normalization.

Last medication: methotrexate 2,5mg, acidum folicum 10mg , Milurit 300mg, Calcichew D3 1-0-0. Vigantol 20 drops once a week, Nolpaza A 40MG 1-0-1, Ramipril 20.5mg 1-0-1, Concor Smg 1-0-0, Agen Smg 1-0-0, Cinarizin 25mg 0-1-0, Cinarizin 25mg 0-1-0, Detralex 500mg 1-0-1.

Allergic Anamnesis: None

Abuses: None

Gynecological anamnesis: She gave two births, she had one abortion during birth and menopause at the age of 38 years.

Diet: Specific diet for dyslipidemia

Family anamnesis: Both of her children are healthy.

Social anamnesis: She lives alone in a ground floor house, her grandchildren live above her house (1st floor) so she has any help she needs.

Hobbies: She doesn't have any specific hobby, but a Physical therapist goes to her home three times a week for functional training.

Occupation anamnesis: She was an elementary school teacher, now she is not working.

Indication Rehabilitation

- Maintain and improve the range of motion
- Prevent any further limitations
- Relax the hypertonic muscles
- Improve Balance and Gait stereotype
- Strengthen the weak muscles

3.3 Initial kinesiological examination

3.3.1 Postural Examination

Anterior view:

Position of the feet- Normal

Shape of the ankle- normal but slightly swelled on the right side

Position of the toes- Inwards

Foot arches- symmetrical

Medial and lateral maleolus- symmetrical

Contour of calf muscle- symmetrical

Position of knee joint- right is external rotated

Patella position- right patella is externally rotated

Medial and lateral sides of quadriceps- right leg is externally rotated

Position of the pelvis- lateral tilt to the left side

Position of the SIAS- asymmetrical left side is higher

Belly muscles- protrusion of the belly (there is no activation of the abdominals)

Symmetry of abdominal muscles (upper and lower part)- asymmetry

Symmetry of thorachobrachial triangles (shape and size)- asymmetrical (left is wider)

Pectoral muscles- hypotrophic

Position of the clavicles - symmetric

Position of the shoulders- asymmetric, left shoulder is higher

Position of the shoulder joints- protracted

Position of the head- protracted

Posterior view:

Shape and position of the ankle joints- supination more on the right side and swelling of the right ankle

Medial and lateral malleolus- right malleolus is swelled

Achilles tendon- supinated (right side more)

Contour of the calf muscles - symmetrical

popliteal line- left is higher

Contour of the thigh muscles- right leg muscles are more prominent

Subgluteal lines- asymmetrical

Position of the pelvis- lateral tilt to the left side

Position of the spine- hyperkyphosis of Th1-Th6

Position of the thoracobrachial triangles- asymmetrical right side is wider

Level and shape of scapulas- adducted, elevated both of them, left side is more elevated.

Level of the shoulders- elevation of shoulders, more on the left side

Position of the head- straight but protracted

Lateral view (left):

Weight distribution- she puts more weight on the left leg

Contour of the shin- normal

Position of the knee joints- hyperextension

Contour of the thigh muscles- normal

Position of the pelvis- anterior tilt

Spine- Hyperkyphosis between th1-th6, hyperlordosis of lumbar spine and hyperlordosis of cervical spine

Shape of abdominal muscles- prominent belly (no activation of abdominal muscles)

Position of the shoulders- protracted

Position of the head- protracted

Lateral view(right):

Weight distribution- she puts more weight on the left leg

Contour of the shin- swelled

Position of the knee joints- slight flexion

Contour of the thigh muscles- normal

Position of the pelvis- anterior tilt

Spine- Hyperkyphosis between th1-th6, hyperlordosis of lumbar spine and hyperlordosis of cervical spine

Shape of abdominal muscles- prominent belly, no activation of abdomnals

Position of the shoulders- protracted

Position of the head-protracted

3.3.2 Gait analysis

Base of support	Wide base of support
Walking rhythm	Non-periodic
Walking speed	Slow
Stride Length	Short steps
Movement of the foot	<u>Heel strike</u> - Not optimal (specially the right foot) <u>Flat foot</u> - Not optimal (foot arch on the right foot is not optimal) <u>Loading response</u> - Normal <u>Heel off</u> - Normal <u>Toe off</u> - Right foot is not optimal , left foot is normal
Axial position of the Lower Limb	Flat right foot, the right hip joint is in External rotation
Movement and position of knees and hips	Left knee and hip movements are optimal during gait. Right knee joint flexion is limited and left hip joint extension is also limited.

Movement and position of Pelvis	Pelvis is in ante version, limited lateral tilt movement during the gait.
Movement and position of the Trunk	The trunk is in ante flexion and slightly shifted to the right.
Abdominal and back muscles activity	No activation of abdominal muscles (protruded belly) , back muscles are activated excessively
Position and movement of the Head and Upper Extremities	Head is protracted. Movement and swing of the UE is not optimal, left Shoulder/elbow there is not a big movement. Elevated and protracted shoulders.

Table 1. Gait analysis

3.3.3 Gait modification

Walk on soft surface	Normal
Walk with eyes closed	Loses balance after 1-2 steps / Not confident gait
Walk on narrow base	Loses balance after 2-3 steps
Walk backwards	Extension of the right hip is not optimal
Walk up the stairs	Patient is climbing the stairs only with left leg
Walk on heels/ tiptoes	On tiptoes she is able to do 4-5 steps. on heels she loses balance

Table 2. Gait modification

3.3.4 Pelvis palpation examination

Posterior superior iliac spine	Left Spina Iliaca posterior superior is higher than the right side
Anterior superior iliac spine	Left Spina Iliaca anterior superior is higher than the right side
Symmetry and height of Iliac crests	Left Iliac crest is higher than the right
Retroversion/ anteversion of pelvis or lateral tilt	The pelvis is in ante version and into lateral tilt on the left side

Table 3. Pelvis palpation examination

3.3.5 Anthropometric measurements

Lower extremities	Left Side	Right side
Anatomical Length	77	74
Functional length	89	88
	Circumferences of Lower extremities	
15cm above patella	58	58
10cm above patella	49	54
Tuberositas tibiae	40	42
Knee joint - patella	44	47
Calf	40	40
Ankle	28	29
	Circumferences of chest/ thorax during inhalation and exhalation	
Upper chest	1,5	
Mid sternum	2,5	
Xyphoid process	2	

Table 4. Anthropometric measurements (in cm)

3.3.6 Breathing stereotype examination

In standing	Abdominal breathing was observed during standing , using mostly lower ribs without chest expansion
In Sitting	Patient is using her lower thorax mostly, here chest expansion is more visible
Supine lying position	Abdominal breathing, patient doesn't use her chest

Table 5. Breathing stereotype examination

3.3.7 Specific testing

1. Romberg - Test I : Normal
 - Test II : Positive
 - Test III : Positive

The Test is positive as the patient loses her balance as soon as she stands with the feet together.

2. Veale Test - Grade 2, slightly impaired stability with pressed toes.

3. Standing on two scales- Weight distribution is not equal, as she puts more of her weight on the Left Leg. 43 kg on the left leg and 37 on the right leg.

3.3.8 Spine distances

<u>Spine Distances</u>		
Thomayer's Distance	11cm	
Schober Distance	3cm	
Stibor Distance	7cm	
Cepojev's Distance	3cm	
Lateral flexion	Right: 18	Left: 19

Table 6. Spine distances

3.3.9 Goniometry examination

<u>Hip Joint</u>	Active ROM		Passive ROM	
	Right	Left	Right	Left
Extension/ Flexion	S: 10-0-80	S: 5-0-85	S: 15-0-85	S: 10-0-90
Abduction/ Adduction	F: 15-0-0	F: 20-0-5	F: 20-0-5	F: 25-0-10
External/ Internal Rotation	painful	R: 40-0-25	painful	R: 50-0-30
<u>Knee Joint</u>	Right	Left	Right	Left
Extension/ Flexion	S: 90-0-0	S: 90-0-0	95-0-0 Patient feels pain in the end position	100-0-0
<u>Ankle Joint</u>	Right	Left	Right	Left

Dorsiflexion/ Plantar flexion	S: 10-0-30	S: 15-0-35	S: 15-0-35 Patient feels pain in the end position	S: 20-0-40
Eversion/ Inversion	R: 10-0-20	R: 20-0-35	R: 15-0-30 Hard barrier in eversion	R: 25-0-40
<u>Shoulder Joint</u>	Right	Left	Right	Left
Extension/ Flexion	S:20-0-150	S: 15-0-90 Patient feels pain	S: 30-0-165	S: 20-0-95 Patient feels pain in the end position
Abduction	F: 90	F: 80	F: 100	F: 80 Patient feels pain in abduction
Extension in abduction/ Horizontal Adduction	T: 15-0-120	Not possible as the patient can not bring her left shoulder into 90 degrees of Abduction and feels pain	T: 20-0-130	Not possible as the patient can not bring her left shoulder into 90 degrees of Abduction and feels pain

External/ Internal Rotation	R: 60-0-90 Painful in External rotation	R: 55-0-85	R: 60-0-100 Painful in External rotation	R: 60-0-85
<u>Elbow</u>	Right	Left	Right	Left
Extension/ Flexion	S: 0-0-120	S: 0-0-105	S: 0-0-140	S: 0-0-110
<u>Wrist & Finger Joints</u>	Right	Left	Right	Left
Dorsiflexion/ Palmar flexion	S: 50-0-40	S: 30-0-10 Pain during dorsal flexion	S: 60-0-55	S: 35-0-15 Pain during dorsal flexion
Radial/ Ulnar duction	F: 10-0-15	F: 5-0-10	F: 15-0-20	F: 5-0-15 Hard barrier in radial duction
Supination/ Pronation	R: 75-0-85	R: 10-0-70 Pain in supination	R: 80-0-90	R: 15-0-75 Pain in supination

Table 7. Goniometry, End Feel (pain/hard/soft barrier) International SFTR method, Janda Approach

	MCP Joints			
	Active ROM		Passive ROM	
Extension/ Flexion	Right	Left	Right	Left
2nd MCP	S: 0-0-10	S: 0-0-0 Pain in flexion	S: 0-0-15	S: 0-0-5 Pain in flexion
3d MCP	S: 0-0-5 Pain in flexion	S: 0-0-5 Pain in flexion	S: 0-0-10 Pain in flexion	S: 0-0-15 Pain in flexion
4hd MCP	S: 0-0-5 Pain in flexion	S: 0-0-10 Pain in flexion	S: 0-0-10 Pain in flexion	S: 0-0-15 Pain in flexion
5th MCP	S: 0-0-70	S: 0-0-70	S: 0-0-75	S: 0-0-75
Thumb (1st) MCP	S: 5-0-20	S: 10-0-35	S: 10-0-25	S: 15-0-35
Abdcution/ Adduction	Right	Left	Right	Left
2nd MCP	F: 10-0-10	F:10-0-10	F: 15-0-15	F: 15-0-25
3rd MCP	F: 10-0-10	F: 20-0-5	F: 15-0-20	F: 25-0-10
4th MCP	F: 25-0-15	F: 20-0-10	F: 30-0-20	F: 25-0-15
5th MCP	F: 20-0-15	F: 15-0-10	F: 25-0-15	F: 20-0-15
Thump (1st) MCP	F: 15-0-25	F: 20-0-20	F: 20-0-25	F: 20-0-20
Extension/ Flexion	IP1 Joints			
	Right	Left	Right	Left
2nd IP1	S: 0-0-15	S: 0-0-40	S: 0-0-15	S: 0-0-45
3rd IP1	S: 0-0-20	S: 0-0-45	S: 0-0-25	S: 0-0-50
4th IP1	S: 0-0-15	S: 0-0-40	S: 0-0-15	S: 0-0-40
5th IP1	S: 0-0-15	S: 0-0-40	S: 0-0-20	S: 0-0-40
Thumb (1st) IP	S: 0-0-40	S: 0-0-60	S: 0-0-50	S: 0-0-65

Extension/ Flexion	IP2 Joints			
	Right	Left	Right	Left
2nd IP2	S: 0-0-15	S: 0-0-20	S: 0-0-15	S: 0-0-20
3rd IP2	S: 0-0-10	S: 0-0-15	S: 0-0-10	S: 0-0-15
4th IP2	S: 0-0-20	S: 0-0-20	S: 0-0-20	S: 0-0-25
5th IP2	S: 0-0-15	S: 0-0-15	S: 0-0-20	S: 0-0-15
<u>CMC Thumb joint Extension/Flexion</u>	S: 15-0-30	S: 20-0-35	S: 20-0-35	S: 20-0-40
<u>CMC Thumb Joint Opposition</u>	1cm away from the tip of V metacarpal	Tip of V metacarpal	Tip of V metacarpal	Tip of V metacarpal

Table 8. Goniometry. MCP joints and small joints of the hand

3.3.10 Manual muscle strength test

Grading (Kendall)	<ul style="list-style-type: none"> • Grade 0 : No contraction of the muscle • Grade 1: Contraction of the muscle but without movement • Grade 2: Horizontal plane with gravity • Grade 3: Against gravity • Grade 4: Against gravity and Against slight resistance • Grade 5: Against gravity and Against great resistance 	
	Upper Extremities	
Muscle	Right UE	Left UE
Adductor pollicis	Grade 3	Grade 3
Opponens Pollicis	Grade 3	Grade 2
Flexor Pollicis Longus	Grade 3 *Pain	Grade 3 *Pain
Flexor Pollicis Brevis	Grade 3	Grade 2 *Pain
Extensor Pollicis Longus	Grade 4	Grade 3

Extensor Pollicis Brevis	Grade 3	Grade 2 *Pain
Abductor Pollicis Longus	Grade 3	Grade 3
Abductor Pollicis brevis	Grade 3	Grade 2
Abductor Digiti Minimi	Grade 3	Grade 3
Opponens Digiti Minimi	Grade 3	Grade 3
Flexor Digiti Minimi	Grade 3	Grade 2 *Pain
Dorsal Interossei	Grade 3	Grade 3
Palmar Interossei	Grade 3	Grade 2
Lumbricales	Grade 4	Grade 3
Palmaris Longus Palmaris Brevis	Grade 3	Grade 3 *Pain
Flexor Digitorum Superficialis	Grade 2 *Pain	Grade 2 *Pain
Flexor Digitorum Profundus	Grade 3 *Pain	Grade 2 *Pain
Flexor Carpi Radialis	Grade 3 *pain	Grade3 *Pain
Flexor Carpi Ulnaris	Grade 3	Grade 3
Extensor Carpi Radialis Longus	Grade 3	Grade 3
Extensor Carpi Radialis Brevis	Grade 3	Grade 3
Extensor Carpi Ulnaris	Grade 3	Grade 3
Pronator Teres / Quadratus	Grade 3	Grade 2 *Pain
Supinator/ Biceps	Grade 3	Grade 2 *pain
Supinator	Grade 3	Painful
Brachioradialis	Grade 3	Grade 2 *Pain
Coracobrachialis	Grade 3	Grade 2 *Pain
Biceps Brachii Brachialis	Grade 4	Grade 3 *Pain
Triceps Brachii	Grade 3	Grade 3

Deltoid	Grade 3	Grade 2
Anterior Deltoid	Grade 3	Grade 2
Posterior Deltoid	Grade 3	Grade 2
Pectoralis Major Upper	Grade 3	Grade 3 *Pain
Pectoralis Major Lower	Grade 3	Grade 3
Pectoralis Minor	Grade 4	Grade 3
Latissimus Dorsi	Grade 3	Grade 3
Shouler medial rotators: Latissimus dorsi Pecroralis major Subscapularis Teres major	Grade 3	Grade 1 *Pain
mm. Romboidei Levator Scapulae	Grade 2	Grade 2
Trapezius middle part	Grade 3	Grade 3
Lower trapezius	Grade 3	Painful
Upper trapezius	Grade 4	Grade 4
	Lower Extremities	
	Right	Left
Gluteus Maximus	Grade 3	Grade 3
Gluteus minimus	Painful	Grade 3
Gluteus medius	Painful	Grade 3
Tensor Fascia Latae	Painful	Grade 3
Quadriceps Femoris	Grade 4	Grade 4
External Rotators of Hip joint Piriformis, Obturator externus, Obturator internus, Quadratus femurs, Gemellus superior/ inferior	Grade 3 *pain	Grade 3

Internal rotators of hip Semitendinosus, semimembranosus, adductors	Grade 2 *Pain	Grade 3
Medial and Lateral Hamstrings Semitendinosus, Semimembranosus, Biceps femoris	Grade 3	Grade 4
Triceps surae	Grade 4	Grade 4
Peroneal Muscles	Grade 3	Grade 3
Tibialis Anterior	Grade 3	Grade 4
Tibialis Posterior	Grade 3	Grade 4
Extensor Digitorum,	Grade 2	Grade 3
Extensor hallucis longus/ brevis	Grade 2	Grade 3
Flexor Hallucis longus / brevis	Grade 3	Grade 3
Flexor Digitorum Longus/ Brevis	Grade 3	Grade 3
Dorsal Interossei	Grade 2	Grade 3
Plantar Interossei	Grade 2	Grade 3

Table 9. Manual muscle strength test (acc. to Kendall)

3.3.11 Muscle length test

Grading	<ul style="list-style-type: none"> • Grade 0 : No shortness • Grade 1 : Moderate shortness • Grade 2 : Marked shortness 	
Muscle	Right	Left
Ankle plantar flexors -Triceps Surae, Gastrocnemius, Soleus (J)	Grade 1	Grade 1
Hip Flexor Muscles One joint- m.Iliacus, m.Pectineus, m.Adductor longus et brevis (J)	Grade 2	Grade 1
Hip Flexor muscles Two joint- m.Psoas major, m.rectus femurs, m.Tensor fasciae latae, m.Sartorius (J)	Grade 1	Grade 1
Hip Adductors m.Pectineus, m. adductor brevis & magnus& longus, m. semitendinosus, m.semimembranosus, m. gracilis. (J)	*pain, abduction is not possible for the test (contraindication)	Grade 1
Hip extensors m. semitendinosus, m.semimembranosus, m.Biceps femurs (J)	Grade 2	Grade 2
Paravertebral muscles (K)	Grade 2	Grade 2
Pectoralis minor (K)	Grade 1	Grade 1
Pectoralis major clavicle part (K)	Grade 0	Grade 1
Pectorals major sternal part (K)	Grade 0	*Painful shoulder abduction, not able to do the test

Trapezius Muscle	Grade 2	Grade 2
Levator scapulae	Grade 1	Grade 1
Sternocleidomastoid	Grade 1	Grade 2
Scaleni Muscles	Grade 1	Grade 1

Table 10. Muscle length test (acc. to Janda (J) and Kendall (K))

3.3.12 Fascia examination

	Right	Left
Kibler Fold	Restriction on the Lumbar and Lower thoracic	Restriction on the Lumbar and Lower Thoracic
Lumbar fascia caudally	Slight Restriction	Restriction
Lumbar fascia cranially	Slight Restriction	Restriction
Neck Fascia	Restriction	Restriction
Thorax fascia	No restriction	Slight Restriction
Upper extremities (Around shoulder and arm)	Slight Restriction	Restriction
Upper extremities (Around elbow and forearm)	Slight Restriction	Restriction
Metacarpals	Slight Restriction	Restriction

Table 11. Fascia examination

3.3.13 Scar examination

- **Right total hip replacement scar** - Movable in all directions, no pain.
- **Right knee replacement scar** - Painful on the lower part of the scar, not movable in all directions.
- **Left elbow scar**- Movable in all directions, no pain of the scar.

3.3.14 Deep stabilisation system testing

	Right	Left
Hip extension (prone position)	Patient is not able to perform hip extension, there is significant activation of paravertebral muscles. ante version of pelvis	Patient is not able to perform hip extension against resistance, there is significant activation of paravertebral muscles. ante version os pelvis
Hip Flexion (sitting on the edge of the table)	Patient is not able to flex her hips against the gravity	Patient is not able to flex her hips against the gravity
Trunk flexion test (supine position)	Diastasis recti is observed. Ribs are not in caudal direction but they open to the sides. Abdominal muscles are not activated optimally.	
Diaphragm Test (sitting with upright posture)	The patient is not able to create a counter resistance in the lower with the lower part of chest expanding. The chest doesn't remain in caudal position.	

Table 12. Deep stabilisation system testing (acc. to Kolar)

3.3.15 Joint play examination

Lower Extremities	Right	Left
MTP joints	Restricted in dorsal & ventral direction	Restricted in dorsal & ventral direction
Proximal interphalangeal joints	Slightly restricted in dorsal direction, and laterolateral direction	Slightly restricted in dorsal direction

Lisfranc & Chopart	Restricted	Slightly restricted
Subtalar Joint	Restricted	Restricted
Talocrural Joint	Restricted	Restricted
Sacroiliac Joint	Restricted	Restricted
Ilium against the sacrum-springing test in supine position	Restricted	Restricted
The 'spine sign' test	Positive	Positive
Patella	Restricted in cranial direction and laterolateral direction	Slightly restricted in cranial direction
Spine		
Lumbar spine	Springing test in prone. Restriction at L1-L2	
Thoracic spine	Springing test in prone. Restriction at lower thoracic	
Upper extremities	Right	Left
Distal Interphalangeal (DIP)	Restricted in dorsal/ ventral direction and laterolateral direction of 2nd,3rd and 4th DIP	Restricted in dorsal/ ventral direction and laterolateral direction of 2nd,3rd and 4th DIP
Proximal Interphalangeal (PIP)	Restricted in dorsal/ ventral direction and laterolateral direction of 2nd,3rd,4th and 5th PIP	Restricted in dorsal/ ventral direction and laterolateral direction of 2nd, 3rd, and 4th PIP
Metacarpophalangeal (MCP)	Dorsal direction- 1st,2nd,3rd and 4th restricted Ventral direction- 1st, 2nd and 3rd and 4th restricted	Dorsal direction- 1st,2nd,3rd restricted Ventral direction- 1st, 2nd and 3rd restricted
Carpometacarpal (CMC)	Restricted 1st (thumb) 2nd and 3rd	Restricted 1st (thumb) 2nd and 3rd
Pisiform	Restricted	Restricted
Elbow	Free	Restricted in medial and lateral direction

Shoulder	Restricted in caudal direction	Restricted in all directions*painful
Scapula	Free	Slightly restricted
Acromioclavicular joint	Slight restriction in caudal direction	Restricted
Sternoclavicular	Restricted in Dorsal direction	Restricted in Dorsal and ventral direction

Table 13. Joint play examination (acc. to Lewit)

3.3.16 Movement patterns

	Right	Left
Hip extension	Ischiocrural muscles hyper activation Paravertebral muscles activation, and then gluteal muscles	Gluteus maximus activation, paravertebral muscles activation ischiocrural muscles activation
Hip abduction	*Pain/ not able to perform due to hip replacement	Tensor mechanism- flexion and internal rotation of the hip
Trunk flexion	Patient starts the movement with the head protracted , abdominals are not activated optimally, diastasis recti is visible. Iliopsoas activation- legs are raised slightly from the table.	
Neck flexion	Protracted head, continued flexion but SCM muscles are shortened specially on the left side and there is slight rotation of the C spine because of hyper activation of left side flexors	
Shoulder abduction	Elevation of the whole shoulder , activation of trapezius and levator scapulae contra laterally and ipsilaterally, supraspinatus , deltoideus quadratus lumborum. shortened and hypertonic upper trapezius	Excessive elevation of the whole shoulder, painful movement, not possible to complete the movement

Table 14. Movement patterns (acc. to Janda)

3.3.17 Muscle tone palpation

<i>Muscle tone palpation</i>		
Muscle	Right	Left
Quadriceps	Trigger Points	Physiological
Gluteal muscles	Physiological	Physiological
Piriformis	Physiological	Physiological *painful
Hamstrings	Hypertonic	Hypertonic
Hip Adductors	Hypotonic	Trigger Points
TFL	Hypertonic	Hypertonic
Gastrocnemius	Hypertonic/ swelled	Physiological
Pectoralis major	Physiological	Hypertonic
Pectoralis minor	Physiological	Hypertonic
Triceps Brachii	Slightly hypotonic	Slightly hypotonic
Biceps brachii	Hypotonic	Hypotonic
Flexors/Extensors of forearm	Physiological	Hypertonic/ trigger points
Supraspinatus	Physiological	Hypertonic/ trigger points
Infraspinatus	Physiological	Hypertonic/ trigger points
Trapezius	Hypertonic	Hypertonic/jumb response
Sternocleidomastoid	Hypertonic	Hypertonic
Scaleni muscles	Hypertonic	Hypertonic
Levator scapulae	Hypertonic	Hypertonic/ trigger points
Deltoid	Physiological	Physiological
Paravertebral muscles	Lumbar area & Lower thoracic are - Hypertonic Upper thoracic- physiological	Lumbar area & Lower thoracic are - Hypertonic Upper thoracic-Trigger Points

Table 15. Muscle tone palpation

3.3.18 Neurological assessment

- **Level of consciousness** - Normal, she is conscious and aware of the environment, she is awake and alert, very cooperative and oriented in time and place.
- **Cranial Nerves** - Normal functions

Deep tendon reflexes		
	Right	Left
Biceps C5-C6	Normal	Hypo reflex
Brachioradialis C5-C6	Normal	Normal
Triceps C7	Normal	Hyper reflex
Finger flexor C8	Hypo reflex	Hypo reflex
Patella L4	Normal *Pain	Normal
Achilles tendon S1	Hypo reflex	Normal

Table 16. Neurological assessment. Deep tendon reflexes

Examination of Upper Extremities (UE)		
	Positional tests	
Mingazzini's Test	Normal	
Dufour test	Normal - Left arm is not possible to be fully supinated	
Finger/ nose test	Normal	
Rapid alternative movements	Normal- but slow movements	
	Sensation of UE (dermatomes)	
	Right	Left
C5	Normal	Normal
C6	Normal	Normal
C7	Normal	Normal
C8	Normal	Normal

Table 17. Neurological assessment. Examination of UE

Examination of Lower Extremities (LE)		
	Positional Tests	
Mingazzini's Test	Normal	
Lasegue's Test	Normal	
	Pathological Signs	
Babinski's Sign	Negative	
Chadok	Negative	
	Sensation of LE	
	Right	Left
L1	Normal	Normal
L2	Normal	Normal
L3	Normal	Normal
L4	Slight hyposensitive	Normal
L5	Normal	Normal
S1	Normal	Normal
S2	Normal	Normal

Table 18. Neurological assessment. Examination of LE

3.3.19 Conclusion

A.D was Diagnosed with Seronegative Rheumatoid arthritis in 1989. After she had total knee and hip replacement, she complained about pain in the right knee and swelling. She experiences pain and limited range of motion in the MCP and IP joints, also morning stiffness approximately 15 minutes after she wake up. The scale of the pain is 7/10 in the small joints of the hands and left shoulder, and for the knee the pain scale is 6/10.

The patient has hyperkyphosis in the upper thoracic area, and hyper lordosis in the Lumbar area, with anterior tilt of the pelvis, and also lateral tilt of the pelvis to the left. Her gait pattern is not optimal, she uses analgetic gait because she feels the pain on the right knee, and her trunk is shifted anteriorly and laterally to the right side.

While climbing up the stairs she uses only the left leg to make a step.

The outcome of the joint play examination is that her Upper extremities, and specifically the MCP and IP joints are blocked and limited. Range of movement (Goniometry) also analyses that her Upper extremities are limited in a different directions and movements.

The patient's Deep stabilisation system is weak, as well as the Upper extremities muscles, and this results that the movement stereotypes are not in the right pattern due to muscle weakness.

Moreover, her lower extremities are stronger, but the right hip extension is not optimal, and it is very important for the gait.

Hypertonic back and neck muscles were observed with Trigger points.

The patient complains also about scar pain of the right knee, which is not movable in all directions. Fascia examination showed that she is restricted around the neck, on the back (left side is more), around the MCP joints and shoulder fascia also is restricted.

Muscle length test revealed that she has shortness in hip flexors of the right leg (grade 2) , hip extensors of both legs, Upper Trapezius, and sternocleidomastoid muscle. Finally the patient is cognitively without any problems. Sensation is normal.

The patient is willing and motivated to start the therapies, as she said that she doesn't want to use any assistive devices ever.

3.4 Short term therapy plan

- Improvement of posture
- Improve the gait stereotype
- Relax the Hypertonic muscles
- Enhancement of the Joint play
- Improve the Limitation of Fascia
- Stretching of shortened muscles
- Balance exercises
- Reduce the swelling by applying ice packs
- Strengthening of the weak muscles

3.5 Long term therapy plan

- Continuation of the short term therapy plan
- Maintaining good posture through her daily life
- Maintain the Range of movement of the joints
- Self therapies for relaxing her neck muscles
- Balance exercises (with supervision)
- Improve the DLA (daily life activities)
- Strengthen the Deep stabilisation system (3months old position)

3.6 Day to day therapies

Therapy progress:

3.6.1 Session 1

Monday, 18th of January 2021

Duration: 90 minutes (morning and evening session)

Subjective: Patient complained for pain and swelling of the right knee, stiffness of left shoulder and whole left Upper extremity with limitation and pain in the movement of the hands.

Objective: From the examination, neck fascia, fascia around the left shoulder and Lumbar fascia in caudal direction on the left side were limited. Also upper trapezius is hypertonic and shortened on both sides, along with levator scapulae.

Right knee scar examination was painful on the lower area of the scar, and was not movable in all directions. Pain level of knee and shoulder is 7/10.

Joint play was limited mostly in the hands (DIP, IP, MCP, pisiform, left elbow, shoulder and scapula).

Goals of today's therapeutic unit:

- Release the restricted fascia of the neck, shoulder, elbow and around the small joints of the hand.
- Release the restricted Lumbar fascia especially on the left side.
- Relax the hypertonic muscles of the neck and paravertebral muscles.
- Improve the scar mobility of the right knee.
- Improve the joint play of the hands and shoulder.
- Balling relaxation and facilitation soft techniques on the neck, shoulder, elbow and hands.
- Active tendon gliding exercises to improve ROM of the hands.

Therapy Applied:

- Soft tissues techniques of the lumbar fascia in caudal direction of left side.
- Soft tissue techniques around the neck, shoulder, elbow and small joints of the hand.
- Balling techniques for relaxation on the neck and left Upper extremity around the shoulder, elbow and forearm.
- Joint play mobilisation of left shoulder in all directions and scapula mobilisation.
- Joint play mobilisation of MCP, IP, DIP and Pisiform bone on both sides.
- Patella mobilisation of the right knee in all directions.
- PIR of upper trapezius, levator scapulae and paravertebral muscles on both sides three times on each side until release is felt.
- Scar massage and mobilisation in all directions of the right knee.
- Active tendon gliding exercises of the hands
 - Flexion/ Extension of all the fingers (making a fist)
 - Flexion/ Extension of the IP joints only
 - Flexion/ Extension of the DIP joints only
 - Abduction/ Adduction of all the fingers
 - Opposition of the thumb and little finger

*Each exercise 5 repetitions , 3 sets.

Self therapy:

- Active tendon gliding exercises of the hands
 - Flexion/ Extension of all the fingers (making a fist)
 - Flexion/ Extension of the IP joints only
 - Flexion/ Extension of the DIP joints only
 - Abduction/ Adduction of all the fingers
 - Opposition of the thumb and little finger

*Each exercise 5 repetitions , 3 sets.

- Active movements of Elbows (Flexion/ Extension) and Shoulders (Flexion/ Extension, Abduction/ Adduction) with correct posture (explained not to elevate shoulders and overuse trapezius)

Results of today's therapeutic unit:

The patient is willing and motivated to exercise. In the end of the therapy she said that she felt more relaxed in the shoulder neck and hands. The patient felt slight pain during the active tendon gliding exercises and during the scar massage. This was the first session with the patient so most of the time was used for the initial kinesiological examination and anamnesis of my patient. I advised the patient to use the Active tendon gliding exercises of the hands

3.6.2 Session 2

Tuesday , 19th of January 2021

Duration: 50 minutes

Subjective: Patient today said that she feels relieved in the neck area and around the left shoulder. Today patient still complained for pain and swelling of the right knee (pain is still 6/10) , stiffness of left shoulder is less. The small joints of the hands are still stiff, feeling pain during thumb opposition of left hand today.

Objective: After yesterday's therapy, patient's shoulders are not so elevated like yesterday, but the examination of neck and around the shoulder fascia was again stiff (less than yesterday).

TrgPs in the thenar eminence.

Goals of today's therapeutic unit:

- Release the restricted fascia of the neck, shoulder, elbow and around the small joints of the hand.
- Release the restricted Lumbar fascia especially on the left side.
- Relax the hypertonic muscles of the neck and paravertebral muscles.
- Improve the scar mobility of the right knee.
- Improve the joint play of the hands and shoulder.
- Balling relaxation and facilitation soft techniques on the neck, shoulder, elbow and hands.
- Active tendon gliding exercises to improve ROM of the hands.
- Relax opponens policis muscle
- Treat Trigger points of thenar eminence

Therapy Applied:

- Soft tissues techniques of the lumbar fascia in caudal direction of left side.
- Soft tissue techniques around the neck, shoulder, elbow and small joints of the hand.
- Balling techniques for relaxation on the neck and left Upper extremity around the shoulder, elbow and forearm.
- Joint play mobilisation of left shoulder in all directions and scapula mobilisation.
- Joint play mobilisation of MCP, IP, DIP and Pisiform bone on both sides.
- Patella mobilisation of the right knee in all directions.
- PIR of upper trapezius, levator scapulae and paravertebral muscles on both sides three times on each side until release is felt.
- Scar massage and mobilisation in all directions of the right knee.
- PIR of Opponens policis.
- Soft tissue techniques and gentle pressure massage of thenar eminence and palm.
- Active tendon gliding exercises of the hands
 - Flexion/ Extension of all the fingers (making a fist)
 - Flexion/ Extension of the IP joints only

- Flexion/ Extension of the DIP joints only
- Abduction/ Adduction of all the fingers
- Opposition of the thumb and little finger

*Each exercise 5 repetitions , 3 sets.

Self therapy:

- Active tendon gliding exercises of the hands
 - Flexion/ Extension of all the fingers (making a fist)
 - Flexion/ Extension of the IP joints only
 - Flexion/ Extension of the DIP joints only
 - Abduction/ Adduction of all the fingers
 - Opposition of the thumb and little finger

*Each exercise 5 repetitions , 3 sets.

- Self treatment PIR of opponens policis muscle of left hand.
- Self treatment PIR of flexors and extensors of forearm of left UE.

Results of today's therapeutic unit:

The patient today was very satisfied with the therapy. She express the feeling of relaxation in the neck and shoulders. She felt slight pain during scar massage. During the active tendon gliding exercises she felt better and the pain now is 6/10. When the patient left the room I observed that her head and shoulders are still protracted but slightly in a better posture than yesterday.

3.6.3 Session 3

Wednesday , 20th of January 2021

Duration: 50 minutes

Subjective: Patient said that she feels relieved in the neck area and around the left shoulder. The soft tissues and balling techniques, PIR helps her a lot. The pain of the thumb opposition is not there anymore. She still feels pain of the right knee but the pain level today is 6/10. She complains for pain in the left shoulder and elbow with level of pain 5/10.

Objective: After yesterday's therapy, neck fascia is much better, left shoulder ROM is limited more in abduction.

Goals of today's therapeutic unit:

- Relax the hypertonic Hamstrings.
- Release the restricted fascia of the neck, shoulder, elbow and around the small joints of the hand.
- Release the restricted Lumbar fascia especially on the left side.
- Relax the hypertonic muscles of the neck and paravertebral muscles.
- Improve the scar mobility of the right knee.
- Improve the joint play of the hands and shoulder.
- Balling relaxation and facilitation soft techniques on the neck, shoulder, elbow and hands.
- Active tendon gliding exercises to improve ROM of the hands.

Therapy Applied:

- PIR of the Hamstring muscles , three times on each side until release is felt.
- Soft tissues techniques of the lumbar fascia in caudal direction of left side.
- Soft tissue techniques around the neck, shoulder, elbow and small joints of the hand.
- Balling techniques for relaxation on the neck and left Upper extremity around the shoulder, elbow and forearm.
- Joint play mobilisation of left shoulder in all directions and scapula mobilisation.
- Joint play mobilisation of MCP, IP, DIP and Pisiform bone on both sides.
- Patella mobilisation of the right knee in all directions.
- PIR of upper trapezius, levator scapulae and paravertebral muscles on both sides three times on each side until release is felt.
- Scar massage and mobilisation in all directions of the right knee.
- Active tendon gliding exercises of the hands
 - Flexion/ Extension of all the fingers (making a fist)
 - Flexion/ Extension of the IP joints only
 - Flexion/ Extension of the DIP joints only
 - Abduction/ Adduction of all the fingers
 - Opposition of the thumb and little finger

*Each exercise 5 repetitions , 3 sets.

Self therapy:

- Active tendon gliding exercises of the hands
 - Flexion/ Extension of all the fingers (making a fist)
 - Flexion/ Extension of the IP joints only
 - Flexion/ Extension of the DIP joints only
 - Abduction/ Adduction of all the fingers
 - Opposition of the thumb and little finger

*Each exercise 5 repetitions , 3 sets.

- Self treatment PIR of flexors and extensors of forearm of left UE.
- Self treatment PIR of levator scapulae on both sides using breathing.

Results of today's therapeutic unit:

The patient today was satisfied with the therapy. She feels more relaxed in the neck and shoulders. Scar massage was not painful this time and the mobility was much better in all directions except caudal direction. Active tendon gliding exercises were more fluent in movement with almost no pain (3/10) When the patient left the room i observed that her head and shoulders are still protracted but in a better position than yesterday.

3.6.4 Session 4

Thursday , 21st of January 2021

Duration: 40 minutes

Subjective: Patient said that she feels much better, less stiffness when she wakes up in the morning in the neck area and also of the hands. She still feels pain of the right knee but the pain level today is 4/10. She still complains for pain in the left shoulder and elbow and the level of pain is 6/10.

Objective: After yesterday's therapy, neck fascia is much better, left shoulder ROM is limited more in abduction.

Goals of today's therapeutic unit:

- Relax the hypertonic Hamstrings.
- Relax Calve muscles
- Release the restricted fascia of the neck, shoulder, elbow and around the small joints of the hand.
- Release the restricted Lumbar fascia especially on the left side.
- Relax the hypertonic muscles of the neck and paravertebral muscles.
- Improve the scar mobility of the right knee.
- Improve the joint play of the hands and shoulder.
- Balling relaxation and facilitation soft techniques on the neck, shoulder, elbow and hands.
- Active tendon gliding exercises to improve ROM of the hands.

Therapy Applied:

- PIR of the Hamstring muscles , three times on each side until release is felt.
- PIR of gastrocnemius and soleus.
- Soft tissues techniques of the lumbar fascia in caudal direction of left side.
- Soft tissue techniques around the neck, shoulder, elbow and small joints of the hand.
- Balling techniques for relaxation on the neck and left Upper extremity around the shoulder, elbow and forearm.
- Joint play mobilisation of MCP, IP, DIP and Pisiform bone on both sides.
- Patella mobilisation of the right knee in all directions.
- PIR of upper trapezius, levator scapulae and paravertebral muscles on both sides three times on each side until release is felt.
- Scar massage and mobilisation in all directions of the right knee.
- Active tendon gliding exercises of the hands
 - Flexion/ Extension of all the fingers (making a fist)
 - Flexion/ Extension of the IP joints only

- Flexion/ Extension of the DIP joints only
- Abduction/ Adduction of all the fingers
- Opposition of the thumb and little finger

*Each exercise 5 repetitions , 3 sets.

Self therapy:

- Active tendon gliding exercises of the hands
 - Flexion/ Extension of all the fingers (making a fist)
 - Flexion/ Extension of the IP joints only
 - Flexion/ Extension of the DIP joints only
 - Abduction/ Adduction of all the fingers
 - Opposition of the thumb and little finger

*Each exercise 5 repetitions , 3 sets.

- Self treatment PIR of flexors and extensors of forearm of left UE.
- Self treatment PIR of levator scapulae on both sides using breathing.

Results of today's therapeutic unit:

Patient complained about “burning” pain during the hamstring PIR and Calve muscles PIR. She feels more relaxed in the neck and shoulders. Scar massage was not painful this time and the mobility was much better in all directions. Active tendon gliding exercises were more fluent in movement with almost no pain (3/10)

3.6.5 Session 5

Friday , 22nd of January 2021

Duration: 60 minutes (30 minutes in the morning and 30 minutes in the afternoon)

Subjective: Patient said that she feels much better, less stiffness when she wakes up in the morning in the neck area and also of the hands. Knee pain is better with level of pain 4/10. Left shoulder is less painful (5/10).

Objective: After yesterday's therapy, neck fascia is much better. Left shoulder abduction is possible until 80 degrees with less pain than the first day.

Goals of today's therapeutic unit:

- Correct Posture and balance
- Relax the hypertonic Hamstrings.
- Relax Calve muscles
- Release the restricted fascia of the neck, shoulder, elbow and around the small joints of the hand.
- Release the restricted Lumbar fascia especially on the left side.
- Relax the hypertonic muscles of the neck and paravertebral muscles.
- Improve the scar mobility of the right knee.
- Improve the joint play of the hands and shoulder.
- Strengthen the Deep stabilisation system

Therapy Applied:

- PIR of the Hamstring muscles , three times on each side until release is felt.
- PIR of gastrocnemius and soleus.
- Soft tissue techniques around the neck, shoulder, elbow and small joints of the hand.
- Joint play mobilisation of MCP, IP, DIP and Pisiform bone on both sides.
- Patella mobilisation of the right knee in all directions.
- PIR of upper trapezius, levator scapulae and paravertebral muscles on both sides three times on each side until release is felt.
- Scar massage and mobilisation in all directions of the right knee.
- Correct posture in front of a mirror. Correction of shoulder and head protraction, activation of abdominal muscles, explained to the patient how to bring her pelvis into retroversion to avoid hyperlordosis of lumbar spine.
- SMS training of foot. Explained the three points of foot and distribution of weight
- Balance exercises on unstable surfaces with weight shifting, on tiptoes and on heels approx. 10 repetitions. (next to the wall bars for prevention of falling).
- 3 month old position, using a medicine ball, pushing collaterally with the left leg towards the right hand, and opposite. 5 repetitions x 3 sets.

Self therapy:

- Active tendon gliding exercises of the hands
 - Flexion/ Extension of all the fingers (making a fist)
 - Flexion/ Extension of the IP joints only
 - Flexion/ Extension of the DIP joints only
 - Abduction/ Adduction of all the fingers
 - Opposition of the thumb and little finger

*Each exercise 5 repetitions , 3 sets.

- Self treatment PIR of flexors and extensors of forearm of left UE.
- Self treatment PIR of levator scapulae on both sides using breathing.
- Self Treatment PIR of Quadratus lumborum

Results of today's therapeutic unit:

The patient today expressed the feeling that she was tired from balance and posture exercises.

PIR of hamstring and calve muscles was more bearable, still feeling the burning feeling. She feels more relaxed in the neck and shoulders. Scar massage was not painful and the mobility of the scar is normal now. Patient was not successful in the three month old position exercise as she was able to have only 1 set and then she expressed the feeling that she is tired.

3.6.6 Session 6

Monday , 25th of January 2021

Duration: 40 minutes

Subjective: Patient said that during the weekend she felt relaxed specially in the neck and shoulders. She complained about pain in the right knee after walking up the stairs and she stumbled. She worked on the self therapy I gave her and she feels satisfied that she did these exercises because her grasping now and the daily life activities are much easier from before the sessions. Pain level of the knee is 3/10 after the stumble and shoulder pain is now 4/10. She is able to perform shoulder Abduction until 90 degrees with almost no pain.

Objective: After the weekend the patient seems more relaxed. The posture has improved, ante version of pelvis is less, and protraction of head and shoulders is in a better position. Joint play of the small joints of the hands is not restricted as before, only the IP and DIP joints of the second and third fingers are more blocked.

Goals of today's therapeutic unit:

- Correct Posture and balance
- Strengthen the Deep stabilisation system
- Relax the hypertonic Hamstrings.
- Relax the hypertonic muscles of the neck and paravertebral muscles.
- Improve the joint play of the hands and shoulder.
- Improve the flexion of fingers using Varigrip strengthening exerciser
- Improve the extension of fingers using Resistance band

Therapy Applied:

- Varigrip exerciser for Active flexion of the fingers. 10 reps x 3 sets alternatively both hands.
- Resistance band for Active extension of the fingers. 10 reps x 3 sets alternatively both hands.
- PIR of the Hamstring muscles , three times on each side until release is felt.
- Joint play mobilisation of MCP, IP, DIP and Pisiform bone on both sides.
- Patella mobilisation of the right knee in all directions.
- PIR of upper trapezius, levator scapulae and paravertebral muscles on both sides three times on each side until release is felt.
- Correct posture in front of a mirror. Correction of shoulder and head protraction, activation of abdominal muscles, explained to the patient how to bring her pelvis into retroversion to avoid hyperlordosis of lumbar spine.
- SMS training of foot. Explained the three points of foot and distribution of weight
- Balance exercises on unstable surfaces with weight shifting, on tiptoes and on heels approx. 10 repetitions. (next to the wall bars for prevention of falling).
- 3 month old position, using a medicine ball, pushing collaterally with the left leg towards the right hand, and opposite. 5 repetitions x 3 sets.

Self therapy:

- Active tendon gliding exercises of the hands
 - Flexion/ Extension of all the fingers (making a fist)
 - Flexion/ Extension of the IP joints only
 - Flexion/ Extension of the DIP joints only
 - Abduction/ Adduction of all the fingers
 - Opposition of the thumb and little finger

*Each exercise 5 repetitions , 3 sets.

- Self treatment PIR of flexors and extensors of forearm of left UE.
- Self treatment PIR of levator scapulae on both sides using breathing.
- Self Treatment PIR of Quadratus lumborum

Results of today's therapeutic unit:

Today's therapy was mostly focused on posture, balance and gait correction. Patient after balance and posture exercises expresses the feeling that she is tired. Patient's posture is more optimal than it used to be. Head and shoulder protraction is slight but not as before. Ante version of pelvis improved and when she walks out of the department I observe that her gait is more optimal and her trunk is not shifted to the right like it used to. Three month old position exercise was practiced only in 2 sets and not 3.

3.6.7 Session 7

Tuesday , 26th of January 2021

Duration: 45 minutes

Subjective: Pain level of the knee is 3/10 and shoulder pain is now 4/10. She is able to perform shoulder Abduction until 90 degrees with no pain. She is very happy because she said her shoulder improved so much that it's easier for her to put her clothes on.

Objective: The posture has improved, ante version of pelvis is less, and protraction of head and shoulders is in a better position. Patient's gait is more optimal, she doesn't use the analgesic gait anymore. Joint play of the small joints of the hands is not restricted as before, only the IP and DIP joints of the second and third fingers are more blocked.

Goals of today's therapeutic unit:

- Correct Posture and balance
- Relax the hypertonic Hamstrings.
- Relax Calve muscles
- Release the restricted fascia of the neck, shoulder, elbow and around the small joints of the hand.
- Focus on the IP and DIP of second and third fingers of both hands joint play.
- Relax the hypertonic muscles of the neck and paravertebral muscles.
- Improve the joint play of the hands and shoulder.
- Improve the flexion of fingers using Varigrip strengthening exerciser
- Improve the extension of fingers using Resistance band

Therapy Applied:

- Varigrip exerciser for Active flexion of the fingers. 10 reps x 3 sets alternatively both hands.
- Resistance band for Active extension of the fingers. 10 reps x 3 sets alternatively both hands.
- PIR of the Hamstring muscles , three times on each side until release is felt.
- PIR of gastrocnemius and soleus.
- Soft tissue techniques around the neck, shoulder, elbow and small joints of the hand.
- Joint play mobilisation of MCP, IP, DIP and Pisiform bone on both sides.
- Patella mobilisation of the right knee in all directions.
- PIR of upper trapezius, levator scapulae and paravertebral muscles on both sides three times on each side until release is felt.
- Correct posture in front of a mirror. Correction of shoulder and head protraction, activation of abdominal muscles, explained to the patient how to bring her pelvis into retroversion to avoid hyperlordosis of lumbar spine.
- SMS training of foot. Explained the three points of foot and distribution of weight
- Balance exercises on unstable surfaces with weight shifting, on tiptoes and on heels approx. 10 repetitions. (next to the wall bars for prevention of falling).
- Using a wooden stick, patient stands in front of a mirror, correcting her posture as we learned , using the wooden stick and correct breathing, Flexion/ Extension of elbows holding the stick, then flexion of the shoulders with extended elbows until the ROM that she is able without provoking major pain. 5 reps x 3 sets in each exercise.

Self therapy:

- Active tendon gliding exercises of the hands
 - Flexion/ Extension of all the fingers (making a fist)
 - Flexion/ Extension of the IP joints only
 - Flexion/ Extension of the DIP joints only
 - Abduction/ Adduction of all the fingers
 - Opposition of the thumb and little finger

*Each exercise 5 repetitions , 3 sets.

- Self treatment PIR of levator scapulae on both sides using breathing.
- Self Treatment PIR of Quadratus lumborum

Results of today's therapeutic unit:

Patient's physical condition has improved as long as she was able to perform all the balance and posture exercises without complaining about being tired. Patient's posture is more optimal than it used to be. Head and shoulder protraction is slight but not as before. Ante version of pelvis improved and when she walks out of the department I observe that her gait is more optimal and her trunk is not shifted to the right like it used to and she is activating her abdominal muscles during standing and walking now. Shoulder ROM is 90-95 degrees in abduction without pain anymore, and flexion of shoulder now is optimal.

3.6.8 Session 8

Wednesday , 27th of January 2021

Duration: 50 minutes

Subjective: Patient today felt pain and stiffness in the joints because the weather was cold and the barometric pressure changed.

Objective: The posture has improved, ante version of pelvis is less, and protraction of head and shoulders is in a better position. Patient's gait is more optimal, she doesn't use the analgesic gait anymore. Joint play of the small joints of the hands is not restricted as before, only the IP and DIP joints of the second and third fingers are more blocked.

Goals of today's therapeutic unit:

- Balling techniques for relaxation on the neck and left Upper extremity around the shoulder, elbow and forearm.
- Relax the hypertonic Hamstrings.
- Relax Calve muscles
- Release the restricted fascia of the neck, shoulder, elbow and around the small joints of the hand.
- Focus on the IP and DIP of second and third fingers of both hands joint play.
- Relax the hypertonic muscles of the neck and paravertebral muscles.
- Improve the joint play of the hands and shoulder.
- Improve the flexion of fingers using Varigrip strengthening exerciser
- Improve the extension of fingers using Resistance band
- Strengthen the Deep stabilisation system

Therapy Applied:

- PIR of the Hamstring muscles , three times on each side until release is felt.
- PIR of gastrocnemius and soleus.
- Soft tissue techniques around the neck, shoulder, elbow and small joints of the hand.
- Joint play mobilisation of MCP, IP, DIP and Pisiform bone on both sides.
- Patella mobilisation of the right knee in all directions.
- PIR of upper trapezius, levator scapulae and paravertebral muscles on both sides three times on each side until release is felt.
- SMS training of foot. Explained the three points of foot and distribution of weight
- Using a wooden stick, patient stands in front of a mirror, correcting her posture as we learned , using the wooden stick and correct breathing, Flexion/ Extension of elbows holding the stick, then flexion of the shoulders with extended elbows until the ROM that she is able without provoking major pain. 5 reps x 3 sets in each exercise.
- 3 month old position, using a medicine ball, pushing collaterally with the left leg towards the right hand, and opposite. 5 repetitions x 3 sets.

Self therapy:

- Active tendon gliding exercises of the hands
 - Flexion/ Extension of all the fingers (making a fist)
 - Flexion/ Extension of the IP joints only
 - Flexion/ Extension of the DIP joints only
 - Abduction/ Adduction of all the fingers
 - Opposition of the thumb and little finger
- *Each exercise 5 repetitions , 3 sets.
- Self treatment PIR of levator scapulae on both sides using breathing.
 - Self Treatment PIR of Quadratus lumborum

Results of today's therapeutic unit:

Pain level of the knee is now 2/10 and shoulder pain is now 3/10. She is able to perform shoulder Abduction until 90-95 degrees with no pain. She is very happy because the daily life activities are not so hard anymore as she expressed. Patient's posture is more optimal than it used to be. Head and shoulder protraction is slight but not as before. Ante version of pelvis improved and when she walks out of the department I observe that her gait is more optimal and her trunk is not shifted to the right like it used to and she is activating her abdominal muscles during standing and walking now. Shoulder ROM is 90-95 degrees in abduction without pain anymore, and flexion of shoulder now is optimal. 3 month old position was successfully practiced today in 3 sets.

3.6.9 Session 9

Thursday , 28th of January 2021

Unfortunately I was not able to finish the last two sessions and final kinesiologic examination with my patient because she was tested positive for Covid-19 virus.

My plan was to give her a feedback of her posture and gait. Continue with soft techniques of the neck and Upper extremities as long as it helped her. Also, as self treatment I spoke with my supervisor which she passed on the information to the patient in order to continue her daily active tendon gliding exercises, continue the self treatment PIR of hand flexors , extensors, trapezius muscle and levator scapulae. Also I recommended her from the previous day if she is able to buy the Varigrip exerciser for finger flexion and an elastic band for finger extension. Lastly I recommended her to continue doing the exercises we used to do during the sessions such as standing in front of a mirror with a wooden stick and performing active flexion and extension of elbows and shoulders, using the correct breathing stereotype as we practiced.

I also recommended her to buy if she can a medicine ball and practice the three month old position as we practiced together during the last sessions.

Since I was not able to do the final kinesiologic examination I will summarise the information about the therapies effectiveness that I observed during the last therapies.

3.7 Effectiveness of Therapy

3.7.1 Posture

- From the initial kinesiologic examination, the patient had major head and shoulders protraction, now after the therapies the protraction improved, there is still slight protraction.
- Scapulas are not adducted anymore and both shoulders are at the same level.
- Pelvic tilt to the left side improved. SIAS and SIPS are now symmetrical
- Belly protrusion is slightly improved, visual activation of abdominals and para-vertebral muscles while standing.
- Right patella is in ideal position
- Thoracic hyperkyphosis (Th1-Th6) it is not optimal but it is in a better alignment than before.
- Lumbar lordosis is slightly less as long as we worked on the pelvic ante version during the sessions and it improved slightly.
- Trunk is not shifted to the right anymore.
- Distribution of weight is better
- Left knee joint hyperextension improved, and right knee slight flexion is better.

3.7.2 Gait

- Gait got improved day by day as I observed her coming at leaving the rehabilitation department.
- Movement of the foot is slightly better. Her steps are still short but her balance is much better.
- Right knee and Hip movements during the gait improved. Knee flexion and hip extension are not limited anymore.
- Abdominal muscles are now activated during the gait
- Para-vertebral muscles are also activated but not excessively as before.

- Swing movement of Upper Extremities is now improved, she was not using her left UE for swinging.
- Shoulders are not elevated anymore.
- Modification of gait: during the sessions we worked on balance exercises on unstable surfaces, with weight shifting on the tiptoes and heels. As I observed, the heel stand was improved markedly.

3.7.3 Breathing

- During the exercises, in standing position, we worked a lot on the correct breathing pattern, and day by day the patient was able to also use her thorax for breathing, not just the abdomen and lower ribs. Chest expansion is optimal now.

3.7.4 Goniometry

- Unfortunately as I was not able to measure all the joints again, I observed the ROM during the therapies.
- Left shoulder ROM improved in flexion and abduction, she was not able to bring her shoulder in flexion without pain, now she is able to go 100 degrees of Flexion without pain, and 95-100 degrees of abduction without pain.
- Hip extension improved, as I observed during the gait.
- Elbow flexion improved.
- Hand, wrist and finger ROM is not optimal, but it improved majorly as the patient's grasping and from the exercises of Tendon gliding and active flexion and extension against resistance in the end of the sessions was not painful and the ROM was much better.

3.7.5 Fascia

- Neck fascia, and fascia around shoulder and Upper extremities got improved, as I observed the fascia almost everyday from the therapies.
- Thoracolumbar fascia also got improved

3.7.6 Scar

- Right knee scar is now movable in all directions, and the pain is gone.

3.7.7 Deep stabilisation system and Movement Stereotypes

- Deep stabilisation system got stronger as the three month old position using a medicine ball in the beginning of the therapies was really difficult for her, it now got improved. Hip extension from the movement stereotypes got improved as I observed during the gait.

3.7.8 Joint Play

- Joint play of the small joint of the hand, DIP, IP, MCP, elbow and shoulder (specially left upper extremity) got improved, they are not blocked as they were before.
- Patella mobility is not limited anymore, is movable in all directions.

4. Conclusion

The first goals of the therapies with the patient were established successfully.

Firstly the main goal was to prevent any further limitations of the hands, improve her Daily life activities in a level where she would't need any help. We surely achieved this goal at a very good level, as the pain scale was now 3/10 (except the days that is cold and the pressure changes) , the range of motion of her hands and generally the upper extremities got markedly improved. Her strength got improved, grasping things, wearing her own clothes (ADL) is easier for her as she expressed. Movement of the DIP, IP, MCP wrist elbow and shoulder is not restricted anymore. Slight restriction only in DIP, IP and MCP of index and 3rd finger of both hands, but much better than before.

The next goal was to reduce the muscle tightness and fascia restriction. Patient expressed the feeling of relaxation specially in the neck area and around the shoulder, this was also visible from her posture during sitting, standing or even walking, head and shoulder protraction are now more optimal. she also expressed that she used to have some headaches in the past, feeling "pressure" in the neck area, and now the headaches are gone. This makes me also very happy because the therapies effects were successful.

Another goal for my patient, was to improve her posture and gait. I am really happy to see her whole posture got improved, and she always remembers the exercises of how the ideal posture should be , and she corrects it at any time. Even after we finish the therapy and the supervisor was translating my feedback to the patient, I saw her being in-front of the mirror correcting her posture.

Gait is so much better as she doesn't use analgesic gait anymore. There is no trunk shifting during gait, she learned how to activate abdominal muscles, hip extension is ideal, and foot movements got improved.

Lastly, the goals were achieved successfully according to my patient's abilities and willingness to practice and do all the therapies and self-therapies I recommended her. There is no more pain in the knee joint, fascias are not markedly restricted anymore, joint play is not restricted, my patient's balance got improved, her posture, gait and general physical condition is in a better level than before.

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6.3 Abbreviations

AMPA: Anti-modified protein antibodies

ANA: Antinuclear antibody

CBC: Complete blood count

CCP: Cyclic citrullinated peptide

CCP: Cyclic citrullinated peptide

CMC: Carpometacarpal

CMP: Comprehensive metabolic panel

CRP: C-reactive protein

DIP: Distal phalangeal

DMARDs: Disease-Modifying anti-rheumatic drugs

ESR: Erythrocyte sedimentation rate

FLS: Fibroblast-like synoviocytes

IP: Interphalangeal

LE: Lower extremity

MCP: Metacarpophalangeal

MRI: Magnetic Resonance Imaging

NSAIDs: Non-steroidal anti-inflammatory drugs

OA: Osteoarthritis

PIP: Proximal interphalangeal

PIR: Post isometric relaxation

PT: Physical therapy

RA: Rheumatoid arthritis

RF: Rheumatoid factors

ROM: Range of motion]

SIAS: Spina iliaca anterior superior

SLE: Systemic lupus erythematosus

STT: Soft tissues techniques

TENS: Transcutaneous electrical nerve stimulation

TFL: Tensor fascia latae

Th: Thoracic spine UE: Upper extremity

6.4 Ethics Committee Agreement

CHARLES UNIVERSITY
FACULTY OF PHYSICAL EDUCATION AND SPORT
Josef Martího 31, 162 52 Prague 6-Vešleslavín

Application for Approval by UK FTVS Ethics Committee

of a research project, thesis, dissertation or seminar work involving human subjects

The title of a project: Case Study of Physiotherapy Treatment of a Patient with Rheumatoid Arthritis

Project form: Bachelor's Thesis

Period of realization of the project: January 2021 – February 2021

Applicant: Silia Ioannidou, UK FTVS, Physiotherapy Department

Main researcher: Silia Ioannidou, UK FTVS, Physiotherapy Department

Workplace: Revmatologický ústav

Supervisor: Mgr. Ilona Kučerová

Project description: The main goal of this research case study is to examine and inspect the patient diagnosed with seronegative rheumatoid arthritis. Physiotherapeutic methods and techniques application, short term and long term plan according to the patient's circumstances are applied. The aim of this case study is to improve the patient's activities of daily living and also to prevent any further complications (most importantly range of movement and improve the ability to walk and stand). Moreover, the research is focused on the general overview of rheumatoid arthritis disease.

Characteristics of participants in the research: In this research only one participant will take place. The patient is female, her age is 79 years old. The patient is an incoming patient where she underwent different radiological and laboratory examinations.

Ensuring safety within the research: Prevention of falls is provided. The patient is able to walk without any support, and during the sessions precautions will take place. Non-invasive methods are being used, manually and with Soft balls, medicine balls, resistive bands, gym ball. During the practicals in the rheumatology department kinesiological examination and physiotherapy sessions will be applied to the patient to get all the information about the patient's situation and chief complaints, under the supervision of Mgr. Markéta Mikulášová. Risks of therapy and methods will not be higher than the commonly anticipated risks for this type of therapy.

Ethical aspects of the research: The collected data will be anonymized within one week after the end of working with the patient. I understand that anonymization means that the text does not use any item of information or combination of items that could lead to the identification of a person. I will be careful not to enable recognition of a person in the text of the thesis, especially within the anamnesis. After the text has been anonymized, any personal data still kept elsewhere will be deleted. Photographs of the participant will be anonymized within one week after being taken by blurring the face, parts of the body or any characteristics that could lead to identification of the person. After anonymization any non-anonymized photographs will be deleted. All collected data will be safely stored on a PC safeguarded by a keyword in a locked room, any data in paper form will be kept safely under lock and key in a locked room. The data will be processed, safely retained and published in an anonymous way in the bachelor thesis.

I shall ensure to the maximum extent possible that the research data will not be misused.

Informed Consent: attached

It is the duty of all participants of the research team to protect life, health, dignity, integrity, the right to self-determination, privacy and protection of the personal data of all research subjects, and to undertake all possible precautions. Responsibility for the protection of all research subjects lies on the researcher(s) and not on the research subjects themselves, even if they gave their consent to participation in the research. All participants of the research team must take into consideration ethical, legal and regulative norms and standards of research involving human subjects applicable not only in the Czech Republic but also internationally.

I confirm that this project description corresponds to the plan of the project and, in case of any change, especially of the methods used in the project, I will inform the UK FTVS Ethics Committee, which may require a re-submission of the application form.

In Prague, 20th of January 2021

Applicant's signature:

Approval of UK FTVS Ethics Committee

The Committee: Chair: doc. PhDr. Irena Parry Martínková, Ph.D.
Members: prof. PhDr. Pavel Slepíčka, DrSc.
doc. MUDr. Jan Heller, CSc.
PhDr. Pavel Hráský, Ph.D.
Mgr. Eva Prokešová, Ph.D.
Mgr. Tomáš Ruda, Ph.D.
MUDr. Simona Majorová

The research project was approved by UK FTVS Ethics Committee under the registration number:

Date of approval:

UK FTVS Ethics Committee reviewed the submitted research project and **found no contradictions** with valid principles, regulations and international guidelines for carrying out research involving human subjects.

The applicant has met the necessary requirements for receiving approval of UK FTVS Ethics Committee.

UK FTVS Ethics Committee
Fakulta tělesné výchovy a sportu
Josef Martího 31, 162 52, Praha 6

Stamp of UK FTVS

Signature of the Chair of
UK FTVS Ethics Committee

6.5 Informed consent

UNIVERZITA KARLOVA
FAKULTA TĚLESNÉ VÝCHOVY A SPORTU
Josef Martího 31, 162 52 Praha 6-Vešelavín

INFORMOVANÝ SOUHLAS

Vážená paní, vážený pane,

v souladu se Všeobecnou deklarací lidských práv, nařízením Evropské Unie č. 2016/679 a zákonem č. 110/2019 Sb. – o zpracování osobních údajů, Helsinskou deklarací, přijatou 18. Světovým zdravotnickým shromážděním v roce 1964 ve znění pozdějších změn (Fortaleza, Brazílie, 2013) a dalšími obecně závaznými právními předpisy Vás žádám o souhlas s prezentováním a uveřejněním výsledků vyšetření a průběhu terapie prováděné v rámci praxe na, kde Vás příslušně kvalifikovaná osoba seznámila s Vaším vyšetřením a následnou terapií. Výsledky Vašeho vyšetření a průběh Vaší terapie bude publikován v rámci bakalářské práce na UK FTVS, s názvem

Cílem této bakalářské práce je

Získané údaje, fotodokumentace, průběh a výsledky terapie budou uveřejněny v bakalářské práci v anonymizované podobě. Osobní data nebudou uvedena a budou uchována v anonymní podobě. V maximální možné míře zabezpečím, aby získaná data nebyla zneužita.

Jméno a příjmení řešitele Podpis:.....

Jméno a příjmení osoby, která provedla poučení..... Podpis:.....

Prohlašuji a svým níže uvedeným vlastnoručním podpisem potvrzuji, že dobrovolně souhlasím s prezentováním a uveřejněním výsledků vyšetření a průběhu terapie ve výše uvedené bakalářské práci, a že mi osoba, která provedla poučení, osobně vše podrobně vysvětlila, a že jsem měl(a) možnost si řádně a v dostatečném čase zvážit všechny relevantní informace, zeptat se na vše podstatné a že jsem dostal(a) jasné a srozumitelné odpovědi na své dotazy. Byl(a) jsem poučen(a) o právu odmítnout prezentování a uveřejnění výsledků vyšetření a průběhu terapie v bakalářské práci nebo svůj souhlas kdykoli odvolat bez represí, a to písemně zasláním Etické komisi UK FTVS, která bude následně informovat řešitele.

Místo, datum

Jméno a příjmení pacienta Podpis pacienta:

Jméno a příjmení zákonného zástupce⁴

Vztah zákonného zástupce k pacientovi Podpis:

6.6 Image attachment



Effectiveness of therapy: Before and after the sessions