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Medical rehabilitation of patients with rheumatoid arthritis according to disability and disease activity

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THE RESEARCH CONCEPTUAL FRAMEWORK

Research actuality

Rheumatoid arthritis (RA) is a chronic and progressive disease that mainly affects the connective tissue and joints. About 0.5 - 1.5% of the population are affected by RA. The disease is more common in women affecting all the body systems, particularly the joints [1,2]. The causes of the disease are unknown yet. Many factors can lead to the onset and development of this disease. Genetic factors, autoimmune causes, harmful habits and microbial infections can increase the incidence of RA [3]. The peak of RA incidence occurs in people aged between 30 - 45 years old, during the period of the highest professional activity. In developed countries, RA is associated with low productivity at work [4]. The severity of the inflammatory process in RA is more worsened by the fact that over 50% of patients cease their professional activities during the first 5 years of disease, whereas disability occurs in 10% of cases in the first 2 years from the disease onset [5]. Joint degeneration and the risk of subsequent functional impairment often affect the quality of life in patients with RA [6]. Although RA management has been greatly improved recently, the best therapeutic approach has not been identified yet. Several anti-rheumatic pharmacological agents are currently available, such as conventional synthetic and biological DMARDs [7]. Anti-inflammatory drug treatment suppresses the activity of the immune system and reduces the synthesis of inflammatory mediators, relieving the symptoms of the disease and slowing down joint impairment. However, the disease requires monitoring and treatment throughout the lifetime. Joint pain restricts functionality, daily activities, workload capacity and quality of life. The therapeutic approach of patients with RA involves both pharmacological and non-pharmacological treatment aimed at increasing functional independence. Functional rehabilitation treatment increases overall functional activity [8].

Despite many recent impressive breakthroughs in pharmacological and therapeutic approaches, patients with rheumatoid arthritis often require considerable functional rehabilitation. The need for physiological treatment is determined by the functional and structural deficiencies of the joint system, caused by a slow and progressive joint degeneration. Rehabilitation focuses on improving joint function and stability, increasing muscle strength and resistance, and reducing pain and inflammation. The main rehabilitation objectives for these patients are the maintenance and improvement of joint functionality and posture control, as well as overall joint mobility [9].
A combined approach of functional methods with pharmacological treatment is highly important. Patients with RA administer a great number of drugs for achieving and maintaining adequate control of the disease [10].

Therefore, further researches on the mechanisms of action of natural and artificial physical factors are required, which will increase the effectiveness of complex recovery treatment in patients with varying degrees of activity in rheumatoid arthritis. It is necessary to study the action of the rehabilitation programs in patients with RA in different periods of the disease activity within a randomized controlled study to assess the importance of implementing these programs into their rehabilitation process.

The purpose of the study was to develop and assess the effectiveness of medical rehabilitation programs in patients with rheumatoid arthritis, depending on their functional disability and the disease activity degree.
The following objectives were set to achieve the purpose of the study:

1. To assess the clinical and functional peculiarities of patients with rheumatoid arthritis as related to their functional disability and the degree of the disease activity.
2. To choose the medical rehabilitation means and methods by determining the optimal combinations for medical rehabilitation programs of patents with rheumatoid arthritis according to their functional disability and disease activity.
3. To assess the effectiveness of medical rehabilitation programs combined with physiotherapy techniques and occupational therapy designed for patients with rheumatoid arthritis.
4. To estimate the impact of rehabilitation programs combined with physical therapy and occupational therapy techniques on quality of life of patients with rheumatoid arthritis.

Research methodology:

The present paper analyzed the research findings in accordance with the purpose and objectives of the study. The research was based on the clinical examination, by assessing the painful and swollen joint counts, somatoscopy, somatometry, anthropometry, as well as recording the inflammatory markers, imaging methods and modern clinical tools, being statistically processed. To achieve the outlined objectives, the present analytical research was conducted on 78 consecutive patients, diagnosed with rheumatoid arthritis based on the 2010 EULAR / ACR and 1987 ARA classification criteria that include articular and extra-articular clinical manifestations, laboratory findings, X-ray assessment and joint balance outcomes. Patients were randomly divided into 2 groups, namely group 1 – the control group, including 40 patients with RA, rehabilitated via a conventional program and group 2 – the study group with 38 patients, who underwent a combined conventional program with methods of occupational therapy. Patients in both groups were assessed at the beginning of treatment (T1) and within 30 days after the end of the treatment program (T2). Statistical analysis of the study results was carried out via the Microsoft Excel and MedCalc programs.

The important scientific problem solved in the thesis. The study confirmed the need to develop differentiated programs for medical rehabilitation of patients with rheumatoid arthritis depending on their functional disability and disease activity. An algorithm for selecting patients according to the musculoskeletal functional residual capacity, disease activity and risk of complications was proposed for the first time.

Scientific novelty and originality. The present research was carried out on a sample of patients with rheumatoid arthritis assessed by clinical, para-clinical and functional methods. A complex examination was carried out according to our proposed algorithm, which made it possible to more clearly divide patients into study groups by assessing the level of disease activity, the remaining function of muscles and joints, and the risk of complications. The determination of comorbidities contributed to establishing a certain functional diagnosis, as well as a rehabilitation treatment program both for a conventional approach and active methods of occupational therapy for each patient individually.

Theoretical significance of the research. The study revealed a variety of functional disabilities in people with rheumatoid arthritis, as well as determined the optimal combination of means and methods of physiological rehabilitation for patients with rheumatoid arthritis.

The applicative value of the research paper. An algorithm was designed for the clinical and functional assessment of patients with rheumatoid arthritis according to their disability and disease activity which allowed to differentially select patients for physiological treatment, as well as for an optimal combination of means and methods of rehabilitation. The obtained results will serve as a basis for the development of combined rehabilitation treatment programs to improve the

quality of medical rehabilitation services. The economic and social importance of the research implementation is conditioned by a decrease in analgesic use and disability rate, as well as by the early return to work of the patients.

Implementation of the research results. The study results were included in the clinical activity of the University Centre for Medical Rehabilitation by implementing three innovative acts, as well as in the teaching activity of the Department of Medical Rehabilitation, Physical Medicine and Manual Therapy. The impact of joint functional impairment and motor deficits on the quality of life of people with rheumatoid arthritis requires assessment depending on the degree of functional disability and disease activity.

Validation of the scientific results. The research results were reported at 10 national and international forums; the Scientific Conference of academic staff and students within the " The Days of Nicolae Testemițanu State University of Medicine and Pharmacy" Days, October 2016; the Scientific and practical conference with international participation "Medical rehabilitation and sports medicine: theoretical-practical interactions", October 2016; the scientific and practical conference with international participation dedicated to the notorious personality of Nicolae Testemitanu "Multidisciplinary approach to pain syndrome in physical medicine and rehabilitation", April 2017; "International Conference on the 70th Anniversary of Sports Medicine in the Republic of Moldova, Chisinau, October 4, 2017; The 11th conference "Ortho- posture-gnosis - Knowledge for Impact and Disease Control ", Romania, Iași, March 2018; The 41st Annual National Congress of Medical Rehabilitation, Romania, Cluj-Napoca, October 24, 2018; The 12th conference "Ortho –posturo- gnosis - Knowledge for Impact and Disease Control ", Romania, Iași, March 2019; the International Conference "Facing COVID -19 Challenges in sports, rehabilitation and education", Georgia, Tbilisi, June 2020; The National Congress of Physical Medicine, Recovery and Balneology in Romania with international participation, September, 2020.

The positive opinion of the Research Ethics Committee of Nicolae Testemitanu SUMPh No. 35 of 27.12.201661 was received for the research .

The thesis was discussed, approved and recommended for defense at the meeting of the Department of Medical Rehabilitation, Physical Medicine and Manual Therapy (protocol No. 25 of 05/26/2021 and at the Scientific Seminar 321.04 (protocol No. 2 of 05/07/2021).

Publications on the thesis topic. The research materials were rendered in 17 scientific publications, including 1 monographs and chapter in monographs, 7 articles, 2 of them in peer-reviewed journals; presentations and communications at 3 national and 7 international scientific conferences.

Keywords: rheumatoid arthritis, rehabilitation in rheumatoid arthritis, rheumatoid hand, clinical and functional tools, quality of life, disability, physiological treatment

Thesis summary. The research work is presented on 153 pages of electronic text and includes an introduction, 4 chapters, conclusions and practical recommendations, a bibliography with 264 literary sources. The thesis includes 21 tables, 35 figures, and 12 appendices. The study results obtained were rendered in 17 scientific publications and 3 certificates of the inventor.

THESIS CONTENT. INTRODUCTION.

The Introduction describes the actuality and the importance of the studied issue, the purpose and objectives of the research, the scientific novelty of the obtained results, the theoretical importance and the applicative value of the paper, validation of the research results and the summary of the whole thesis.

1. CURRENT ISSUES ON MEDICAL REHABILITATION OF PEOPLE WITH RHEUMATOID ARTHRITIS (literature review)

This chapter summarizes the evidence and evolution of researches on rheumatoid arthritis, epidemiology, as well as RA features. The functional features of the rheumatoid hand and the clinical and functional approach in rheumatoid arthritis were also evaluated. New strategies for the treatment of rheumatoid arthritis were considered, based on early diagnosis of the disease, as well as a prompt and continuous treatment for steady remission was carried out. The relevant researches provide information on the involvement of a rehabilitation model for patients with rheumatoid arthritis, including professional rehabilitation services that can accelerate a person's reintegration into social and professional activities. Rehabilitation is included in the treatment of RA to minimize functional disorders and ease the pain. Relevant studies have reported the benefits of rehabilitation, especially of physiotherapy, in reducing the remaining functional joint. Therefore, adherence to the rehabilitation regimen is considered mandatory for RA treatment. According to the specialized literature, people with rheumatoid arthritis have an increased risk of developing joint deformities and osteoporosis. The use of rehabilitation services in the clinical management of RA patients can reduce the risk of functional disability. Complex rehabilitation programs relieve pain, improve functional status, movement activity and enable to control the disease activity in patients with RA. The kinetic programs targeting at improving hand rehabilitation showed a functional improvement of the whole hand and of each finger. Study results in this area have shown that RA patients with moderate to low disease activity show remarkable results. International guidelines and recommendations provide direct physiotherapy rehabilitation assistance for people with RA to restore their mobility, muscle strength, and controlled hand movements. Rehabilitation of joint mobility is carried out on the basis of functional rehabilitation programs using active kinetic methods. Strong evidence supports the idea of using a group or a combination of group interventions to improve occupational outcomes. Group interventions are more effective in improving the quality of life. According to the specialized literature, over the last decades, several attempts have been made to adjust the pharmacological treatment of anti-rheumatic exercise programs to relieve the symptoms of rheumatoid arthritis and pain, reduce fatigue and improve physical activity by physically training sick people. The use of occupational self-management programs associated with physical activity leads to a decrease in joint pain, a decrease in fatigue and an increase in self-care indicators. Occupational intervention targets daily activities and allows patients to learn how to use these techniques in their daily activities, in a range of occupational and professional activities. Integrating occupational therapy sessions into arthritis rehabilitation measures will increase functional efficacy and maintain the outcomes, by equipping patients with strategies and skills to manage the disease and reduce the remaining joint function.

The literature review in this area shows that occupational therapy interventions aimed at supporting, managing and maintaining health are highly effective in improving occupational performance, quality of life, and reducing the use of health care assistance.

2. MATERIAL AND METHODS

2.1. The statutory clinical features of the study group

The research was conducted within the Department of Medical Rehabilitation, Physical Medicine and Manual Therapy of the IP of the State University of Medicine and Pharmacy "Nicolae Testemitanu" of the Republic of Moldova at the clinical base of the State Hospital over a period of 2017 - 2020. The study is a comprehensive analysis of patients with rheumatoid arthritis, followed by an in-depth assessment of hand damage caused by this disorder. The study was approved by the Research Ethics Committee (no. 35 of 27.12.2016) of IP Nicolae Testemitanu SUMPh, the examination of patients following their signed informed consent. The assessment was carried out on a group of 78 patients diagnosed with rheumatoid arthritis, developed in accordance with the 2010 EULAR / ACR and 1987ARA classification criteria (Table 1 and Table 2), which include articular and extra-articular clinical manifestations, laboratory parameters, radiography and joint balance outcomes. These criteria focus on assessing clinical signs and symptoms. The patients were examined based on a patient survey, designed to include subjective, objective data, as well as clinical, functional, laboratory and imaging findings. The following inclusion and exclusion criteria have been established for study group homogeneity:

Study inclusion criteria:

1. Age over 18 years old.
2. The diagnosis of RA, established according to the criteria developed by the 1987 American Rheumatism Association (ARA) (revised version) and the 2010 EULAR / ACR.
3. Health insurance
4. Patient's agreement on not changing the RA treatment during the study.
5. Patient informed consent.

Study exclusion criteria:

1. Patient refusal
2. Other associated rheumatologic diseases.
3. Decompensated comorbidities.
4. Contraindications to physiological treatment.

The diagnosis of RA was considered reliable if at least 4 of the 7 criteria indicated above were present. Criteria 1-4 must persist for at least 6 weeks. The diagnostic criteria developed by the American Rheumatism Association (ARA) 1987 were also considered, since the study included people older than ten years.

As the study hypothesis was aimed at assessing the effectiveness of kinetic therapy programs to ensure the data representativeness, the sample size was calculated using the formula for a randomized trial.

The sample size was estimated by using the following formula:

$$n = \frac{1}{(1-f)} \times \frac{2(Z_\alpha + Z_\beta)^2 xP(1-P)}{(P_o - P_1)^2}$$

where:

P_o = According to the epidemiological data presented in the literature review [11], the rate of successful rehabilitation of patients with rheumatoid arthritis according to generally accepted schemes amounts for 36.0% (P_0=0.36).

P_1 = We assume that the rate of successful rehabilitation of patients with rheumatoid arthritis via new complex programs will make up 65,0% (P_1 =0.65).

$P = (P_0 + P_1)/2$=0.505

Zα – table value. When „α" – the significance threshold is 5%, then the coefficient Zα =1.96

Z_β– table value. When „β" – the statistical power of two-way comparison is 10.0%, then the coefficient Z_β= 1.28

f = number of subjects who are likely to be excluded from the study for various reasons q = 1/(1-f), f=10,0% (0,1).

By entering the data in the following formula, a number of 69 people was obtained.

$$n = \frac{1}{(1-0.1)} \times \frac{2(1.96+1.28)^2 x 0.52 x 0.48}{(0.36-0.65)^2} = 69$$

After applying the inclusion and exclusion criteria to a study group of 83 patients, we determined that 3 subjects had a high degree of disease activity, one patient had a cardiac pacemaker, and one patient was diagnosed with psoriatic arthritis. These conditions met the study exclusion criteria, thus the patients were excluded from the study.

Thus, 78 patients selected and included in the study group were carefully studied, the data obtained were introduced into an integrated table, designed in accordance with the protocol developed and approved by the research unit, which includes data on the patient's overall condition, clinical manifestations of the disease, data on joint functionality, para-clinical indices and tools for assessing functional capacity, daily activities and quality of life of a RA patient.

Female patients prevailed in the ratio of 2.7: 1 in the study group, predominantly being from rural areas (52.67%). The presented data confirm that patients aged between 29 - 69 years with the onset of the disease being between 19 and 55 years (the mean age of 34.3 ± 4.52) are more commonly diagnosed after 31 years. The mean age of the patients at the time of examination was 51.67 ± 7.37 (29-69 years). Based on the results obtained, we concluded that the average age of the disease onset was 34.3 years, and at the time of examination - 51.67 years, so patients with a disease age of more than 7 years were included within the study. The patients were randomly divided by a random distribution, using sealed envelopes. To provide study accuracy and blind randomization, the envelopes were prepared and sealed by the head of the department and stored in the safe of the Medical Rehabilitation and Physiotherapy Department of the State Hospital. After checking and verifying the study inclusion and exclusion criteria and signing the patient's informed consent, the responsible person from the Medical Rehabilitation and Physiotherapy Department distributed the envelopes. Thus, 78 consecutive patients who summed up the research criteria were divided into 2 groups: Group 1 (control group) which included 40 patients with RA, treated via a conventional rehabilitation program and group 2 (study group) with 38 patients, who underwent a conventional program combined with occupational therapy techniques.

2.2. General and special methods for assessing patients under study

The studied patients underwent a complex examination by using general and special methods according to the research design shown in Figure 3. General examination included the patient's survey, general clinical examination with assessment of painful and swollen joint counts, anthropometry, body mass index (BMI) and assessment of inflammation markers, viz. erythrocyte sedimentation rate (ESR) and C-reactive protein. The erythrocyte sedimentation rate is the rate at which erythrocyte sedimentation occurs from an anticoagulant blood sample over one hour according to the Westergren method, the reference values ranging between 2-15 mm / h for women and 2-10 mm / h for men. C-reactive protein was assessed quantitatively using the latex test, whereas values exceeding 6 mg / l were considered as pathological ones.

The patient's survey was conducted according to a specifically developed questionnaire aimed at collecting data on the patient age at the time of inclusion in the study and the age of the disease onset, disease duration, and family history, current and previous occupational activities. The risk factors that determine the disease (smoking, heredity, physical and psychological stress) were also registered.

Since the incidence of concomitant diseases in patients with RA is high, questions on the presence of associated diseases were included in questionnaire, since the falre-up of a concomitant rheumatoid arthritis process may be a contraindication to rehabilitation physiotherapy treatment with subsequent exclusion of the patient from the study. The clinical examination performed on the day of patient's admission included a standard organ system assessment. Particular attention was paid to the assessment of the osteoarticular system through medical rehabilitation methods like inspection, palpation, assessment of joint mobility, and musculoskeletal structures. Joint manifestations are important for diagnosing the disease and assessing the functional status of the RA patient. We were mostly interested in assessing the elbow deflection of the fist, palmar subluxations, hyperextension of the proximal interphalangeal joints, and flexion deformity of the interphalangeal joints, which are considered signs of hand dysfunction.

Anthropometry was performed by determining body height (Hm) and body weight (G/kg) to estimate the body mass index (BMI) according to the formula recommended by the WHO (2006) - Gkg / Hm^2 with appropriate gradation: normal body mass (BMI $\leq$25 kg / m2), overweight (BMI 25-30 kg / m^2), class I obesity (BMI 30- 34.9 kg / m^2), class II obesity (BMI 35 -39.9 kg / m^2), premorbid class III obesity (BMI $\geq$40 kg / m^2). The joints involved in the inflammatory process were identified following the recommendation of the American College of Rheumatology (ACR) by calculating the painful joint count (PJC) and swollen joint count (SJC), possibly ranging between 0-78 / 0-76.

The hands were examined in half-flexed position followed by palmar inspection. Changes in skin appearance were grouped according to color and local temperature. The examination also detected swellings and their symmetrical arrangement, joint deformities specific to the disease, nodules and hypotonia of the interosseous muscles. By antero-posterior and latero-lateral palpation, the pain in the radio-cubito-carpal joint and of each metocarpophalangeal (MCP), proximal interphalangeal (PIP) and distal (DIP) joint was assessed.

The Squeeze test was performed for the MCP II-IV joints by squeezing the joint with two fingers to the side to assess the pain. When assessing the mobility of the hand, incomplete flexion and extension of the palms, a decrease in elbow and radial deviation were registered.

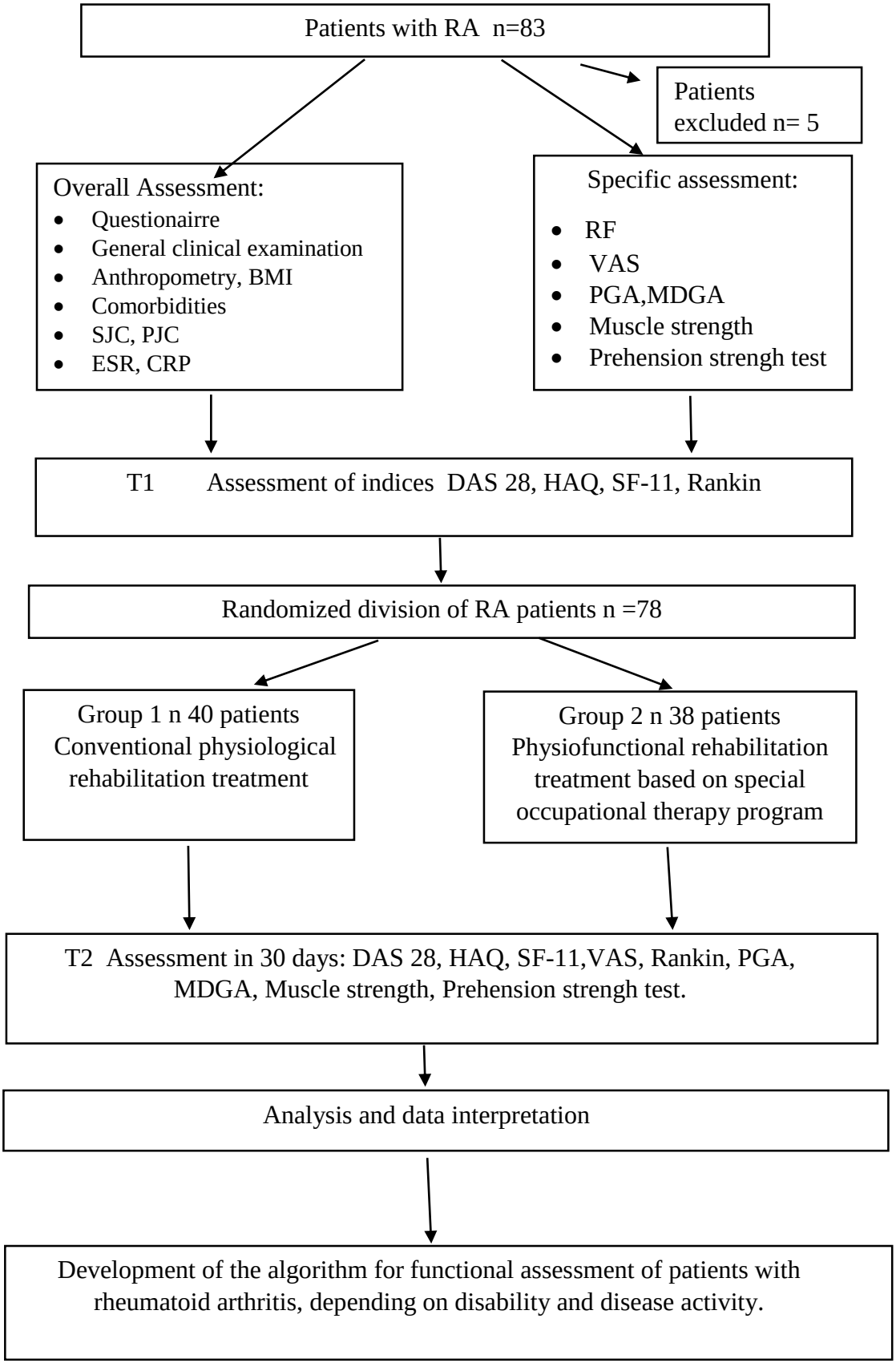

Figure 1. Study design.

The inspection of the hands was completed by assessing the type of RA-related deformities:
- radial deviation of the fist with ulnar (elbow) deviation of the fingers;
- palmar subluxations of the proximal phalanges (Z -deformities);
- hyperextension of the proximal interphalangeal joints with compensatory flexion of the distal interphalangeal joints (swan neck deformity);
- flexion deformity of the proximal interphalangeal joints and extension of the distal interphalangeal joints (buttonhole deformation);
- hyperextension of the first interphalangeal joint and flexion of the first metacarpophalangeal joint with consequent loss of thumb mobility and grip.

Hand functions are provided by 22 joints: 4 carpometacarpal arthrodesis, 3 intermetacarpal arthrodesis, 5 MCP condylar joints, 9 PIP and DIP trochlear-like osteoarthritis joints and the saddle joint opposed to the thumb.

The carpometacarpal joints form the calyx of the hand, by the opposition between the I and V MC in the carpometacarpal joint, constituting a cylindrical grip. The metacarpophalangeal joints allow flexion-extension and lateral movements, as well as the passive rotation (~ 45º) of the finger around its own axis.

The interphalangeal joints (IP) allow only flexion-extension movements around the transverse axis, so the planes of each finger converge to a point at the base of the thumb.

There are two carpometacarpal joints, namely, the saddle joint, where the articular surfaces consist of the trapezius and the I metacarpal of the thumb and four arthrodes, where the articular surfaces are formed of the distal row of carpals and the II, III, IV, V metacarpals. The articular capsule is maintained by the interosseous ligaments, dorsal and palmar carpometacarpals. Three arthrodes represented by the intermetacarpal joints connect the metacarpals to their proximal end, the distal extremities being joined by a transverse ligament that stretches between the II and V metacarpals.

The metacarpophalangeal joints are of the condylar type, the articular surfaces represented by the distal ends of the metacarpals and the base of the distal phalanges of the fingers. The joint unit is provided by a capsule, which wraps like a sleeve around the bony extremities, and by the palmar and collateral ligaments.

The interphalangeal joints of the II-V fingers and thumbs are in proximal and distal positions. The proximal part is the articular surfaces of the II-V fingers, represented by the distal end of the I phalanx and the proximal end of the II phalanx, whereas the distal position is the distal end of the II phalanx and the proximal end of the III phalanx.

The articular surfaces of the thumb in the interphalangeal joints are formed by the distal end of the I phalanx and the proximal end of the II phalanx. The joint stability is maintained by the capsule and the palmar and collateral ligaments.

The major function of the hand is gripping. The thumb and phalanges play mandatory role in basic prehensive actions:

• I: the tip-to-tip pinch grip, regarded to the thumb and index finger
• II: the tripod (pen) grip (of the thumb-index-middle fingers), subterminal grip (in handwriting).
• III: subterminal two-finger grip, between the thumb pulp and the outside of the index finger (when the plate is grasped).
• IV: Poly-digito-palmar prehension (when grasping a hammer) which is a high strength prehension.

• V: Two-digit clamp (when holding the steering wheel).
• VI: Interdigital latero-lateral grasp, especially between the index and middle fingers (when holding a cigarette).

To achieve the objectives of the study, we estimated the grasping features of the finger segments involved in the prehension by using the Sidenco (2005) and Frost (2002) tests [12].

The study assessed the two-digital, three-digital, poly-digital and digitopalmar prehensions by applying a 3-level scale: 0 - normal grasping, 1 - impaired or partially impaired grasping , 2 - impossible prehension. Thus, we tested the two-digital prehension, by termino-pulpal opposition, by subterminal opposition, by subtermino-lateral opposition, the latero-lateral interdigital grasping; three-digital, four- or five-digital prehensions and digito-palmar, palmar, centered, hanging, grappling, and interchangeable gripping.

To outline the prognosis and establish the functional deficit of the patients, the muscle balance was carried out via a system of manual examination techniques to assess the strength of each muscle or muscle group, following the joint balance, being performed in comfortable conditions by the same physician. The study was focused on the global assessment by examining the muscles with the main common actions. The hand muscles consist of flexors and extensors. Palmar and digital flexor muscles that include ulnar flexor of the carpus, radial flexor of the carpus, long palmar, long flexor of the thumb and short flexor of the thumb were assessed in the sitting position, arm next to the trunk, at a flexed angle of 90 ^{o} , in forearm pronosupination. To assess the flexors in the non-gravity position, the forearm in pro-supination was supported by a physiotherapist or placed on a table. The stabilization maneuver was performed in the distal 1/3 of the forearm, subsequently, the ulnar flexor of the wrist was palpated on the anterior face of the forearm, in 1/3 distal position, following the V metacarpal, the radial flexor of the wrist was palpated on the anterior part of the forearm, in 1/3 distal position; the long palmar muscle was palpated on the medial upper part of the forearm. In non-gravity position, the subject performs the fist flexion and the finger flexion in MCP. Moving in an anti-gravity position, the subject performs a fist flexion with his elbow tilted, without resistance or flexion of the fingers in the MCP. We continued testing, keeping the same position, by opposing slight resistance in the hypotenor, tenor, lateral and medial region of the hand and in II-V fingers of the palmar side.

For the long and short flexor muscles of the thumb, the stabilization maneuver was performed at fist by palpating the tendon of the long flexor of the thumb of the second phalanx on the palmar side and the short flexor tendon of the thumb at the proximal phalanx on its palmar side. From a non- gravity position, the subject performs a flexion of the thumb. Subsequently, the flexion was repeated in an anti-gravity position with slight resistance in the thumb, depending on the joint to be tested, keeping the previous position.

The study continued by testing the muscles of the palmar and digital extensors from the non-gravity position after being stabilized in the distal 1/3 position of the forearm and by palpating the ulnar extensor of the wrist on the dorso-lateral side of the forearm and radial extensors on the dorso-medial side of the forearm; digital tendons were palpated on the back of the hand. The balance of the extensors was assessed by fist and finger extension in MCP, in non-gravity position, while in non-gravity sitting position, arm close to the trunk and elbow flexed at 90 ^{o} with the forearm in pronation / pronosupination position, the subject performs an extension of the fist with the elbow tilted and extension of the fingers in MCP. The subject repeated the extensor muscle

movements in the previous position with a slight resistance at the dorso-lateral and dorso-medial side of the hand and at II-V fingers of the dorsal side.

The thumb extensors testing is in the sitting position of the subject with the arm placed next to the trunk, the elbow flexed and the forearm in pronosupination position, followed by fist stabilization, palpation of the long extensor tendon of the thumb in the II finger on the dorsal side and of the short flexor tendon in the proximal finger on its dorsal side. The patient performed the thumb extension in non-gravity position. In non-gravity condition, the patient performed the thumb extension with the arm next to the trunk, elbow flexed and in forearm pronation, by repeating the action with a slight resistance in the thumb and by keeping same position.

Manual muscle strength testing was graded according to the International Scale for Assessing Muscle Strength from 0 to 5 [13]. It was measured in the long palmar muscles and in long flexors of the thumb:

- Muscle strength 5 (normal; 100%) indicates a full range movement against an external force or to a resistance opposed by the physiotherapist, equal to the value of the normal strength. The "normal range" is assessed by comparing it with the opposite healthy segment. The physiotherapist will apply maximum resistance in the middle of the maximum movement stroke, trying to return the segment to the anatomical zero position (eccentric contraction). The force is applied by a progressive physical therapist. The emergence of pain makes testing unnecessary.
- Muscle strength 4 (good; 75%) represents the muscle strength to fully mobilize the segment at moderate resistance. It will be carried out in the same way as in strength 5 testing, but with less resistance from the physiotherapist.
-Muscle strength 3 (acceptable; 50%) is the muscle ability to move through a full range of motion against gravity force (the movement is done vertically), by possibly maintaining, for a few seconds, the "final" position. The strength 3 value represents the muscular functional threshold, which would indicate the least functional capacity for a minimum activity that would require movement in all directions.
- Muscle strength 2 (weak; 25%) is the ability of a muscle or group of muscles to move the segment by using the alternative gravity eliminated position. Manual strength 2 testing requires the precise knowledge of the physiotherapist on the non-gravity position, specific to the muscle being under study. Sliding slats (plastic boards, glossy surfaces, lumber) are commonly used or the segment is supported by a kinetic therapist.
-Muscle strength 1 (very weakly sketched; 10%) refers to the presence or absence of voluntary muscle contraction. This is determined manually by palpating the tendons and / or the muscle, while the subject performs the contraction of the relevant muscles.
- Muscle strength 0 (zero, zero) relates to the muscle that is unable to perform any obvious contraction.

After a special assessment, we quantified pain using an analog visual scale (VAS) [14, 15]. The severity of pain was assessed by a VAS of 100 millimeters, which makes it possible to subjectively assess pain, where the value "0" corresponds to the absence of pain, and 100 refers to the maximum pain (Appendix 2).

The special evaluation we followed with the quantification of pain by Analog Visual Scale (VAS) [14, 15]. The severity of pain was assessed after a VAS of 100 millimeters, which allows the subjective assessment of pain, where the value "0" corresponds to the absence of pain, and the value 100 - maximum pain.

Among specific laboratory studies, we determined the rheumatoid factor (RF) by the latex – immunoturbidimetric method. After a fasting venous blood collection on the vacutainer vessel without anticoagulant and by using a separating gel, 0.5 ml of serum was separated by centrifugation. The serum was stabilized for 24 hours at room temperature. The reference value of RF was <14 IU / mL3 [16].

According to our study objectives, we determined the disease activity using the DAS28 index. The assessment of the disease activity index included the following components, namely, swollen and painful joint counts, calculated according to the Ritchie joint index / joint index 28, ESR (mm / hour), the global disease activity determined by analogous visual scale (100 mm). These data enabled to determine DAS-28 according to the following formula:
DAS28 = 0,56 * sqrt(tender28) + 0,28 * sqrt(swollen28) + 0,70 * ln(ESR) + 0,014 * GH
DAS/DAS28 value The activity degree:

< 3,2 Low activity

≥ 3,2 < 5,1 Moderate activity

≥ 5, 1 High activity

To avoid errors in calculations, the DAS28 index was calculated online on www.das-score.nl. Patients' condition and health problems were assessed using a global rating scale. The overall disease assessment was assessed by the patient using a Patient Global Assessment (PGA) (Appendix 3) and by a physician via a Physician Global Assessment (MDGA). The scales were applied according to the reference VAS scale.

The Rankin scale was used to assess disability in 78 patients with rheumatoid arthritis included in the study, which is a graded tool depending on the patient's self-care skills, ranging between 0 for no disability, 5 for completely dependent, and 6 - death. (Appendix 6), [17]. The disability assessment was carried out according to the following characteristics:

1 point - minor condition, the ability to carry out normal day-to-day activities;

2 points – easy disability, mild condition: the ability to perform only some activities, however the patients are able to care of themselves;

3 points – moderate disability, condition requires supervision of the patient, who is able to walk without help;

4 points – moderate to severe disability, condition refers to patients who are not able to walk without assistance and cannot take care of themselves;

5 points – severe disability, condition describes a bedridden person who needs permanent care.

Daily Living Activity Assessment (ADL) including self-care, household chores, and working and leisure activities was conducted using the HAQ (Health Assessment Questionnaire). The study of daily activities determined the functional level of the subjects, allowed tracking and measuring the functional progress or regression and helped to clarify the level of disability. The questionnaire included free questions (rated as: "*I do it without difficulty"*, "*I do it with some difficulty*," "*I do it with moderate difficulty*" and *"I cannot do it*") in compliance with the requirements stated within the medical and sociological literature. The questionnaire included a short introduction that clearly explained the purpose of the targeted research. This survey was

divided into two parts: General Data and Functional Data. The parameters analyzed were focused on functional assessment (6 questions) and self-assessment of daily skills (14 questions).

The short form quality assessment questionnaire (Short Form, SF-11) is a versatile tool for measuring the quality of life of patients with various diseases. (Annex 5) This tool was selected due to a practical design, well-suited clinical use, and cheapness and has been approved the treatment of several chronic diseases in adults. The questionnaire included a brief introduction, which clearly explained the purpose of the targeted research. By using 11 categories of simple questions, the SF-11 provides a comparable measure of patient well-being in terms of physical function (PF), physical role (PR), general physical condition (GPC), social impact (SI), emotional role functioning, (ER), vitality (VT), general pain (GP), mental state (MS) and general health (GH). Scores range from 0 to 100; the higher the score, the better the quality of life.

2.3. Treatment programs used

The medical rehabilitation treatment of the patient with rheumatoid arthritis is aimed at:

•reducing pain;

• maintaining / increasing joint mobility;

• maintaining / increasing muscle strength and hand stability;

• maintaining, developing and improving the ability of grasping;

Based rehabilitation treatment goals, patient-customized rehabilitation programs on disability and disease activity were designed.

The traditional rehabilitation program focuses on:

Based on the directions of the recovery treatment, we individualized the rehabilitation programs of the patients according to their disability and the activity of the disease.

The conventional rehabilitation program focused on:

1. Restoring the mobility in finger flexion-extension position by adapting passive, auto-passive and active movements;

2. Restoring the flexor and extensor muscle strength of the thumb;

3. Restoring the flexor and extensor muscle strength of the of the II-V fingers;

Prevention and correction of joint deformities and hand deviations is an important physiotherapeutic task. The following interventions should be applied:

-prevention and correction of the elbow deviation of the fingers;

-prevention and correction of "swan neck" deformity;

-prevention and correction of "buttonhole" deformation;

-prevention and correction of the thumb Z- deformity.

The physiological rehabilitation program for recovering the flexion-extension mobility of the fingers, as well as of the flexor and extensor muscles strength involves the following set of exercises:

Set 1 (KT) exercises for patients with moderate to severe disability (4 points, Rankin), the moderate DAS :

-The patient's initial position (IP) is sitting on a chair, the hand is inserted under the ischial tubercle (in pronation or supination), the tilted trunk determines the pressure intensity to take the correct arm posture. The exercise is repeated 5 times for both hands.

- The patient's P.I is sitting on a chair with the hand on the table. The physical therapist performs for each finger joint MCF, IFP, IFD exercises for axial extension or decompression of the joints,

exercises for lateral-lateral sliding or abduction-adduction exercises, exercises for anteroposterior sliding or flexion-extension exercises, exercises for axial rotation or torsion. The physical therapist grasps the juxta-articular bone segments and pulls one segment in one direction, and the other segment is pulled in the opposite direction. Each exercise is repeated 5 times for both hands.

- The patient P.I. is sitting in a chair with the hand on the table. Automated flexion-extension of syndactyly fingers is performed. The movable finger is attached to an adjacent finger, which will mobilize it in the direction of extension or flexion (fixation is carried out with adhesive tapes applied to the fingers). The exercise is repeated 5 times for both hands.
- The patient's P.I. is sitting in a chair with the hand on the table. To match the biomechanical design of the arm, the patient performs joint flexion and extension following the sequence: MCP + PIP + DIP flexion, MCP + PIP flexion + DIP extension, MCP flexion + PIP + DIP extension, PIP flexion + DIP flexion in MCP extension. For the thumbs, the patient will perform exercises to oppose each finger. The exercise is repeated 5 times for both hands.
- The patient's P.I. is sitting in a chair with the hand on the table. The physiotherapist places his palm in the patient's palm, by resisting in finger flexion. The patient performs the thumb flexion, then the fist and elbow flexion, by counteracting against the physiotherapist. The exercise is repeated 5 times for both hands.
- The patient's P.I. is sitting in a chair with the hand on the table. The patient is asked to lift the thumb off the table, without lifting the other fingers. Subsequently, the patient raises each finger separately, without raising the other fingers. The exercise is repeated 5 times for both hands.
- The patient's P.I. is sitting on a chair with the hands on the table. The patient is holding a sponge by exerting pressure in MCP flexion with the fingers extended. The exercise is repeated 5 times.

Set 2 (KT) exercises for patients with moderate disability (3 points, Rankin), the moderate DAS activity

- The patient's P.I. is sitting on a chair with the hand on the table in a comfortable position. Using an elastic band stretched between the thumb and forefinger, the patient achieves a counter-resistance of the thumb in the same plane as the other metacarpal bones. The exercise is repeated 5 times for both hands. Subsequently, the elastic band is passed over the fingers and the patient continues the counter-resistance movements.
- The patient's P.I. is sitting comfortably in a chair. The patient places the fingers of both hands so that the fingers are adjacent to the metacarpal bones of the opposite hand. The physiotherapist places a tennis ball between the palms of the hands, which is strongly pressed by the finger flexor muscles. The exercise is repeated 5 times.
- The patient's P.I. is sitting on a chair with the forearm on the table, holding a cane outside the table (the thumb is placed towards the cane axis). The patient lifts the cane. The exercise is repeated 5 times for both hands.
- The patient's P.I. is sitting in a chair, resting the hand on the table at the elbow edge. The patient successively abducts the thumb and fingers. The exercise is repeated 5 times for both hands.
- The patient's P.I. is sitting in a chair with the hand on the table. By supporting the elbow, the patient performs PIP extension in MCP flexion. The position is maintained for 3 seconds. The patient should maintain an active position, otherwise, a physiotherapist helps him. The exercise is repeated 5 times for both hands.
- The patient's P.I. is sitting on a chair with the forearm on the table. Patient's hand is positioned with the palm down and semi-flexed fingers with support at the fingertips, performing abduction-adduction to straighten the thumb. The exercise is repeated 5 times for both hands.

-The patient's P.I. is sitting on a chair with the forearm on the table. The patient positions the thumb and the index finger in a straight line with a sponge between them, repeatedly pressing on the sponge. The exercise is repeated 5 times for both hands.
The program can be supplemented with exercises for the impairment of the large joints (elbow, shoulder and knee) for each individual patient, in accordance with the initial assessment.

The combined functional rehabilitation program included the conventional kinetic and the occupational therapy techniques, adjusted according to the patient's degree of disability. Occupational therapy made it possible to restore the hand's working capacity with through special trainings. The techniques applied in occupational therapy were grouped according to the patient's functional rest and aimed at restoring daily activities, from the ability to open a door or window to the ability to use a fork and knife or write, as well as other necessary gestures used in patient's profession or at work and/or acquiring a new job-oriented skill, by learning an incomplete or "tricked" skill that would allow the use of hand objects adapted to the functional rest of the hand. The occupational therapy program started from restoring simple or basic gestures, by training separately all types of handgrips, the exercises being performed under the patient's control by having a comfortable and natural position of the hand. Since occupational work sessions should not tire the patient, we suggested repeating them twice a day. The initial starting position was sitting on a chair, hands on a table, the sessions lasting 30 minutes per each and including the following occupational activities grouped into sets according to the assessed degree of disability.
Set 2 (OT) exercises for patients with moderate to severe disability (4 points, Rankin), the moderate DAS
- re-educating the patients through bead playing, by pushing the beads with each finger separately, the other fingers being clenched into a fist, followed by pushing the bead with an outstretched palm, inserting the beads into the wire;
- preventing the DIP joint hyperextension by applying the two-finger and three-finder tip-to-tip prehensions when sorting beads or buttons by size or color, and looking through a book;
- re-educating the pehensive skills through packing / unpacking movements of objects of different sizes; hitting the ground and catching the ball.
Set 2 (OT) exercises for patients with moderate disability (3 points, Rankin), the moderate DAS
- re-educating the patients by sculpting from plasticine or clay, tying and untying the shoelace, making paper objects of "airplane" or "boat" type, sewing and embroidering with a needle, crocheting;
- preventing the DIP joint hyperextension by using the two-finger and three-finder tip-to-tip prehensions to complete the mosaic of beads or buttons, screwing and unscrewing a light bulb, training the handwriting;
- re-educating the pehensive skills by using the knife and fork (P.I: orthosis), drawing, painting, brushing objects, weaving a string.
During occupational therapy sessions, the specialist warns the patient to avoid pronation in gestures involving the use of a poly-finger-palm grip, as well as underlines the use of tip-to-tip two-finger grip.

Both groups of patients underwent 10 sessions of low-frequency magnetic therapy in the distal and proximal metacarpophalangeal and interphalangeal joints. The hand was placed in a tubular-type solenoid, so the magnetic field captured all these joints. The frequency of pulses of the magnetic field of 100 Hz was chosen at an intensity of 30% of the magnetic induction in the geometric center of the inductor, the power of alternating current in the system was 220 V ± 10%,

50 Hz, lasting for 12 minutes. Magnetic therapy was performed using an Alimp-1 magnetic field generator. At the end of the 10-day inpatient treatment, patients were recommended to continue functional treatment for 20 days on an outpatient basis and individually at home with regular exercise and adherence to the duration and intensity of each exercise. After 30 days of recovery, patients were asked for a visit to reassess the clinical and functional parameters of the joint system of the hand and for an overall reassessment of disability, daily skills, and quality of life. Finally, patients were assessed using the MORISKY-8 questionnaire to assess adherence to the physiological treatment suggested (Appendix 9).

2.4. Methods of statistical data analysis

The patient data under study were collected and introduced in a Microsoft Excel database and analyzed in the MEDCALC statistical software version 12.7.0, by using variational, correlational and discriminatory analysis. Pearson's correlation coefficient was used to determine the degree of persuasion of the correlations between the studied parameters to describe the degree of linear relationship between two normally distributed continuous quantitative variables. Pearson coefficient value ranges from +1 to -1 and indicates the direction of the correlation. Numbers with a plus sign indicate a positive correlation, and those with a minus sign indicate a negative one. Pearson's coefficient with values from 0.30 to 0.50 shows a weak correlation, 0.50-0.75 indicates a moderate correlation, and more than 0.75 is a strong correlation.

The correlation coefficient is described concomitantly with the p-value, which represents the probability of obtaining the current results. If the correlation coefficient is zero, there is no correlation (null hypothesis). If this probability is less than 5% ($p<0.05$), then the correlation coefficient is statistically significant. The differences between the mean values of the studied parameters in different groups was determined via the t-Student test.

The Box-Plot analysis allowed the graphical representation of the distribution of maximum, minimum and arithmetic mean values, as well as the standard deviation for each variable.

3. ESTIMATION OF FUNCTIONAL DEFICIENCIES IN PEOPLE WITH RHEUMATOID ARTHRITIS BY CLINICAL AND PARACLINICAL EVALUATION

3.1 Characteristics of clinical and functional parameters in patients with rheumatoid arthritis from the study sample.

The study group included 78 patients, diagnosed with rheumatoid arthritis, of which 57 (73.07%) were women. The mean age of the patients was 51.67 ± 7.37 years, ranging from 29 to 69 years, and the mean duration of the disease was 7.61 ± 3.48 years in the study group, which relates to the epidemiological features of the disease. Thus, in most patients the onset of the disease was after 45 years. After the study inclusion and exclusion criteria were checked and an informed consent was signed, the patients were randomly divided into two similar groups by the envelope method. Analysis of the collected data revealed a predominance of women with a female / male ratio of 2.07: 1 for group 1 and 3.75: 1 for group 2. Thus, a distribution of 52.5% and 52.7% in rural areas for group 1 and group 2 was found. According to the family status of patients, a prevalence of married patients was found viz. 31 (77.5%) in group 1 and 30 (78.9%) in group 2, widowed patients were 3 (7.5%) in group 1 and 4 (10.6%) in group 2, divorced ones were 5 (12.5%) and 3 (7, 8%) in group 1 and group 2, respectively, and a single patient from both groups participated in the study. At the same time, 25 (62.5%) patients from group 1 and 22 (57.9%) from group 2 live with their spouse or life partner, others 1 (2.5%) from group 1 and 2 (5.3%) from group 2 share housing with children, 11 (27.5%) patients in group 1 and 13 (34.2%) in group 2

live with children and life partner and 3 (7.5%) patients in group 1 and 1 (2 , 6%) in group 2 stated living alone at the time of the research. The workplace data of the patients from the study groups showed that 27 (67.5%) patients in group 1 and 30 (78.9%) patients in group 2 were employed full-time, whereas two people from both groups were part-time employees.35 (87.5%) patients from group 1 and 32 (84.2%) patients from group 2 requires fine hand skills in their professional activity and only 5 (12.5%) patients from group 1 and 6 (15.8%) patients in group 2 need overall strength of the hands at work.

The diagnostic criteria assessment revealed that all patients included in the study had morning stiffness. Arthritis of 3 or more joint areas with soft tissue swelling was observed in 39 (97.5%) patients in group 1 and 38 (100%) patients in group 2. Inflammatory involvement of the proximal interphalangeal (PIP), metacarpophalangeal (MCP) or radiocarpal (RC) joints was reported in all subjects from both groups, and symmetric arthritis with concomitant involvement of similar joint areas on both sides was detected in 37 (92.5) patients in group 1 and 36 (94, 7) patients in group 2. Subcutaneous nodules located in the region of bone protrusions on the extensor surface or near the joints were present in 9 (22.5) patients in group 1 and 11 (28.9%) patients in group 2.

The study focused on joint damage that was managed clinically via clinical disease assessment tools. Afterwards, we were interested in systematizing the number of joints involved in the pathological process; thus, the peripheral joints were separately assessed via the Disease Activity Scoring of 28 joints (DAS 28) - adopted by rheumatology for the graphical rendering of joint involvement.

The patients' complaints in terms of pain and swelling were also assessed, as well as their mobility and function impairment by observing the configuration of joint damage. 76 (97.3%) patients reported pain in the proximal interphalangeal joint II and III, 53 (69.7%) patients experienced associated pain in the metacarpophalangeal joint, about 1/2 (48.7%).) of all patients reported radiocarpal pain of the hand, 28 (35.8%) – in the elbow joints and 11 (14.11%) patients reported pain in other joint areas (shoulders and knees).

Subsequent comparative examination of the joints in both groups, allowed to determine the mean swollen joint count (SJC) in group 1 of about 4.35 ± 1.3 joints (min. 2 - max. 8), and 3 , 81 ± 1,4, (min. 3 - max. 6) swollen joints in group 2 , showing a statistically insignificant difference ($p > 0.05$). Pain in proximal interphalangeal, metacarpophalangeal or radiocarpal joints was reported in all patients from both groups. Concomitant pain in the elbow joints was observed in 28 (35.8%) patients, 14.11% of patients reported pain in the shoulder and knee joints. The study was particularly interested in hand gripping since we understood the effectiveness of physiological rehabilitation programs and restoration of the ability of the impaired limbs. The grip test was performed by flexion in the DIP joints under the action of the deep common flexor to stabilize the middle phalanges on each finger in two positions: in non-gravity position when the hand is on the table at the elbow edge, the fist and fingers are relaxed ; in anti-gravity position, the forearm rests on the table, the fist and fingers are relaxed; due to flexion of the middle phalanges in the DIP joints, flexion of the proximal phalanges in the MCP joints, as well as adduction and abduction of the fingers. An initial test , the grasping prehension was performed to assess the functional deficits of the interphalangeal and metacarpophalangeal joints. The assessment results showed insufficiency of the two-finger grip in the subterminal-lateral opposition prehension by having 1,72 ± 0,42 conventional points the 1st group and 1,78±0,42 points in second group, showing statistically significant differences ($p < 0.05$). Patients in both groups demonstrated an effect on

multidigital prehension affected by the inability to perform three-finger grips by 1.85±0.31 ponts in the 1st group and 1.65±0.42 points în second group(p <0.05). Both groups also showed a functional decrease in palmar grip. The indices of the finger-palmar grip test were 1.97±0.34 points în the 1st group and 1.92±0.16 in the second group (p <0.05).
The assessment of the long palm and long flexor muscle strength of the thumb, involved in the flexor and extensor movements of the fingers, and in the wrist rotation was performed manually according to the 6-step International Muscle Strength Assessment Scale from 0 to 5 (0 - 5). The long palm muscle strength had similar values in both groups, being estimated between "acceptable" and "weak" (for long palm muscles- 2.56 ± 0.5 vs. 2.52 ± 0.6, the strength being higher in group 1 (p <0.05), as related to the thumb long flexor muscle, the parameters ranged also between "acceptable" and "weak" (long flexor 2.34 ± 0.4 vs. 2.31 ± 0.5, being also statistically significantly higher in group 1(p <0.01).

Functional disability was assessed according to the Rankin scale. In the 1st study group, where 16 (40%) patients received 4 points, showing moderate to severe disability, not requiring constant care and 24 (60%) patients scored 3 with moderate disability. The 15 (39.47%) patients from group 2 were initially assessed with moderate to severe disability (4 conventional points) and 23 (60.53%) patients with moderate disability (3 points).

3.2. Assessment of the patient with rheumatoid arthritis by paraclinical instruments

To assess the systemic inflammatory process in patients in the study group, non-specific inflammatory markers such as PCR and ESR, as well as the index of disease activity and rheumatoid factor were analyzed. The mean value of the disease activity index, calculated after determining the number of swollen and painful joints according to the Ritchie joint index / joint index 28 and the erythrocyte sedimentation rate (mm / h).). Based on the data obtained, the erythrocyte sedimentation rate was found to be within the normal range for the entire study group, whereas the disease activity index DAS 28 confirms a moderate rheumatoid process in both groups. However, deviations in the erythrocyte sedimentation rate were detected in 21 (52.5%) patients in the 1st group and in 20 (52.6%) in the 2nd group. At the same time, the rheumatoid factor values in the studied groups were 38.3 ± 3.41 IU / ml3 (min.7.1 - max. 70.2) for group 1 and 36.4 ± 2.57 IU / ml3 (min. 6 - max. 68) for group 2 (p <0.05). In 13 (32.5%) patients from the 1st group and 11 (28.9%) patients from the 2nd group, the values of rheumatoid factor in the blood serum exceeded the reference value by <14 IU / ml3.

The X-ray examination showed that 27 (67.5%) patients in group 1 had a radiological stage II and 13 (32.5%) patients had stage III, p> 0.05. Whereas 29 (76.3%) patients from group 2 had a higher frequency of radiological stage II compared to 9 (23.4%) cases of stage III - (p> 0.05). In both groups, there was a predominance of patients with stage II X-ray. Thus, we found no significant difference between groups in terms of the distribution of radiological staging (p> 0.05).

3.3. Determining the disease impact by clinical instruments

The obtained results revealed that joint pain and morning stiffness are the main symptoms of RA in the group of patients under study. The study of pain as a separate element required its quantitative assessment using a visual analogue scale (VAS). The degree of pain syndrome on the VAS scale ranged from 20 to 92 mm with an mean value of 69.26 ± 9.76 mm.

Mild pain (0-30 mm) was experienced by 6 patients, which amounted to 7.69%; severe pain (> 70 mm) was found in 24 (30.76%) patients; 48 patients had moderate pain (31-69 mm), accounting for 61.53%. Thus, at the initiation of moderate pain research, 25 (62.48%) patients in the first group and 23 (60.52%) patients in the second group, severe pain had 12 patients in both batches (group 1-30% and group 2 -31.5%), light pain was reported by 3 (7.5%) patients in 1 group and 3 (8.0%) patients in the 2 group of study.

The self-assessment of the overall health of each patient was carried out using validated clinical tools - the Patient Global Assessment (PGA), compared with the physician's assessment - the Physician Global Assessment (MDGA).

The PGA of the disease impact at the initial assessment (n = 78) was 64.41 ± 12.3 mm for the whole study group , compared to the MDGA - 56.6 ± 13.2 mm , thus reasoning a satisfactory patient's overall condition. Comparative data for both groups are shown in Figure 2.

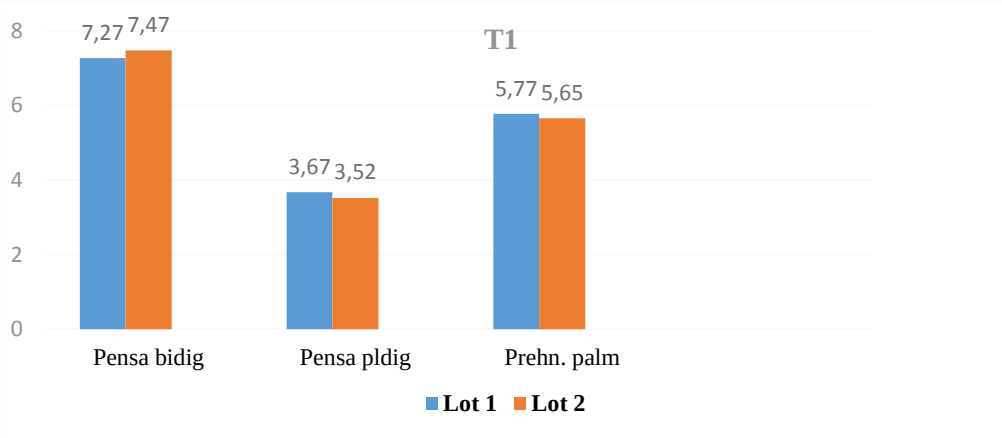

Figure 2. **Patient Global Assessment (PGA) and Physician Global Assessment(MDGA) at T1**

Thus, we determined that at the beginning of the study, patients in group 1 assessed their overall condition as satisfactory, the mean PGA being 65.35 ± 11.5 mm (iv 38-92 mm) per group (p <0.05) . The doctor's assessment in the same group was 57.67 ± 11.4 mm (i-v 31-72) (p <0.05). Patients in group 2 assessed their overall condition as satisfactory, on average 63.47 ± 12.3 mm (iv 37-89) per group , the physician's assessment , however, was more modest being 55.52 ± 9.3 mm (iv 30 - 69, the difference was statistically significant per group (p <0.05) In both groups, the initial assessment showed an underestimation of the patients' overall condition compared to the doctor's assessment.

According to the study design, the HAQ (Health Assessment Questionnaire) for the assessment of daily living activities (ADLs) was applied: self-care, household chores, working and resting activities in patients in the study sample. The HAQ results were used to establish functional progress or regression. Initially, functional regressions and self-care disorders were found in the study group by using HAQ, showing an average value of 1.98 ± 0.63 points with a minimum score of 1 point and a maximum of 3 conventional points (p <0.05), the patients statements being *I do it with some difficulty* and *I do it with great difficulty* (Figure 3)

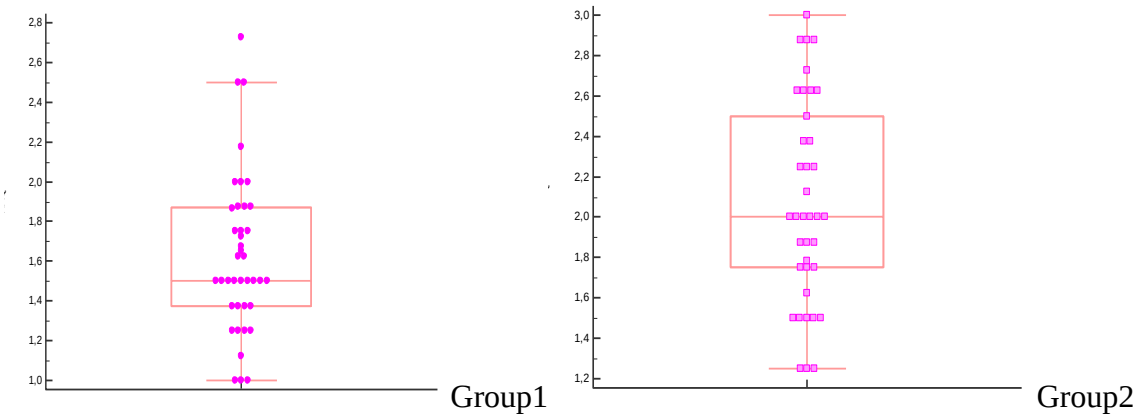

Figure 3. Assessment of daily activities (HAQ) in both study groups at T1

A detailed analysis of the distribution diagram of HAQ scores, showed a redistribution of the patients with a > 2 score in the study group 2, which means a lower functional status compared to the study group 1. Thus, the mean HAQ score was 1.92 ± 0.39 (min. 1 max. 2.7) in the 1st group, and 2.06 ± 0.51 (min. 1.2 max. 3) in the 2nd group, showing a statistically significant difference ($p < 0.05$).

The study assessed the patient quality of life by applying a generic tool for measuring the quality of life - Short Form Life Assessment Questionnaire (Short Form, SF-11). The analysis of SF-11 parameters in both groups highlighted that the overall pain exceeded the moderate intensity in both groups - 23.5 ± 3.8 and 30.5 ± 2.3 ($p > 0.05$), in group 1 and group 2, respectively. Physical functions and their role averaged to 36.6 ± 8.3 / 38.9 ± 5.1 in patients from group 1 and 38.2 ± 9.1 / 41.3 ± 7.3 from group 2 ($p > 0.05$), whereas the general physical condition accounted for 27.5 ± 4.3 in group 1 and 26.7 ± 4.1 in group 2 ($p > 0.05$), which involves significant difficulties in performing physical and daily care activities. At the same time, the score of mental and emotional status was 33.6 ± 6.2 / 28.2 ± 4.1 for group 1 and 40.4 ± 2.1 / 27 ± 3.5 for group 2 ($p > 0.05$), thus suggesting negative emotions present. Social impact and vitality values were assessed as 33.9 ± 6.4 / 23.1 ± 3.6 in group 1 and 35.9 ± 7.3 / 25.2 ± 3.2 in group 2 ($p > 0.05$), thus suggesting a marginalization of interests and the loss of spiritual selflessness. The values of 29.9 ± 4.2 in the 1st group and 26.9 ± 3.6 in the 2nd group obtained when assessing the overall health ($p > 0.05$) confirmed the overall low physical, emotional and mental state in the studied groups.

3.4. Risk factors and comorbidities in patients with rheumatoid arthritis.

Certain risk factors contribute to the burden of rheumatoid inflammation. In the literature they are grouped into non-modifiable risk factors, such as the age 40-60 years, gender - women are three times more likely to get rheumatoid arthritis than men, heredity with worsened family genetic history and lifestyle risk factors like smoking, physical and emotional stress and obesity. The comorbidity occurrence in the study sample was mostly associated with hypertension, followed by diabetes, chronic lung disease (interstitial lung disease, chronic obstructive pulmonary disease and pleurisy), chronic cardiovascular disease (coronary heart disease, cerebrovascular disease, and peripheral vascular disease, and congestive heart failure), chronic kidney disorders (pyelonephritis) and nervous impairment.

3.5 The attitudes of RA patients to therapeutic rehabilitation

Medical rehabilitation of patients with rheumatoid arthritis involves pharmacological and physiological approaches. The variety of pharmacological remedies for RA includes the following types of drugs: 1. anti-inflammatory drugs (non-steroids and glucocorticoids) with a more symptomatic effect; 2. Remission drugs (DMARDs) with a pathogenetic effect. Pathogenetic treatment with methotrexate from the category of remission drugs (DMARD) was carried out in 48 (61.5%) patients in the study group. 8 (10.2%) patients received a symptomatic treatment with diclofenac (NSAIDs), and 22 (28.3%) patients administered diclofenac in combination with methylprednisolone.

The study participants showed moderate active disease activity, which is not a contraindication for physiological treatment. The initial assessment of disability by Rankin scale divided the patients from the study into the group with moderate disability that required monitoring most of the physical activities and the group with moderate to severe disability, who had a moderate-to-severe condition, being unable to take care of themselves. Depending on the disability degree, both conventional and physiological treatment were carried out in combination with occupational therapy methods (Table 1).

Table 1. Rehabilitation treatment applied depending on the disability grading

Treatment	Moderate disability	Moderate to severe disability
Conventional recovery treatment (Group1)	N abs. 24 (60%)	N abs. 16 (40%)
	Set 2 (KT)	Set 1 (KT)
Recovery treatment combined with occupational therapy(Group2)	N abs. 23 (60,53%)	Nabs. 15 (39,47%)
	Set 2 (KT) + Set 2 (OT)	Set 1 (KT) + Set 1 (OT)

Thus, moderate-severe disability (4 points, Rankin scale) of patients conditioned the application of kinetotherapeutic exercises in Set 1 (KT) to 16 (40%) of patients in group1 for the recovery of the flexor muscle and extensions of the police and fingers II-V and prevention and correction of deformities and joint deviations of the hand. Recovery treatment combined with occupational therapy methods for 15 (39.47%) people with moderate-severe disability in group 2 included active sessions in Set1 (KT) and methods in Set 1 (OT).

Option of 24 (60%) of patients with moderate disabilities (3 points, Rankin scale) in group 1 was Set 2 (KT) in conventional treatment. For 23 (60.53%) patients with moderate state in group 2 recovery sessions included exercises from Set 2 (KT) and Set 2 (OT).

4. 4. EABORATION AND EVALUATION OF THE EFFICACY OF FUNCTIOONAL PHYSIO TREATMENT PROGRAMS IN PATIENTS WITH RHEUMATOID ARTHRITIS

4.1 Evaluation of physiological parameters in patients with rheumatoid arthritis.

After a 10-day rehabilitation inpatient care and 20 days at home, with the total duration of one month, the patients were functionally re-assessed by clinical tests to follow the dynamics of physiological parameters and the restored changes of manual skills (group 1 underwent a conventional rehabilitation program, group 2 – treatment program combined with occupational therapy). The assessment of the two-finger, multi-finger and palmar grips was performed by the same tests as at the time of study entry. A comparative study of the groups was performed at the initial time T1 and at the end of the treatment T2. The test results of two-finger, multi-finger and palmar prehensile grips are presented in figure 4.

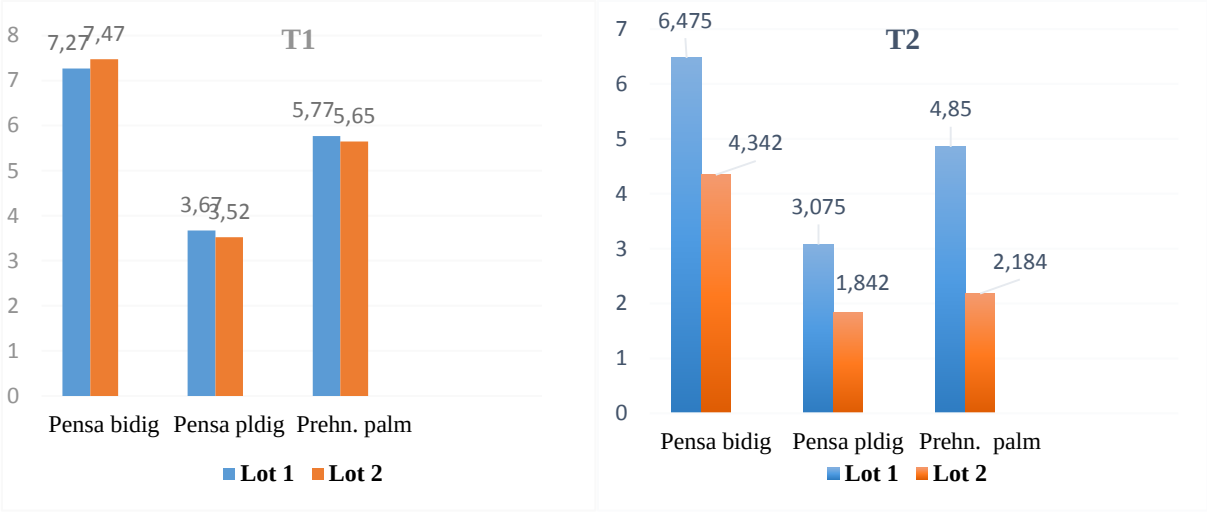

Figure 4. **The dynamic evolution of griping in the study groups.**

After a month of physiological treatment, both study groups reported a decrease in the conventional scores for all types of prehensile grips, which means an improvement of prehensile movements. Thus, the two-finger grip had a lower score ranging from 7.27 ± 0.33 to 6.47 ± 0.31 in group 1 and from 7.47 ± 0.29 to 4.34 ± 0.33 in study group 2 ($p < 0.05$); the multifinger grip had even a lower scoring in group 2 - from 3.52 ± 0.15 to 1.84 ± 0.17 ($p < 0.05$) compared to group 1 , having from 3.67 ± 0.21 to 3.07 ± 0.11 ($p < 0.05$); and the palm grip score decreased from 5.77 ± 0.29 to 4.85 ± 0.27 ($p < 0.05$) in group 1 and from 5.65 ± 0.24 to 2.18 ± 0.21 ($p < 0.05$) in study group 2. The results show a recovery of prehensile function in both groups, particularly in patients who underwent a combined physical with occupational therapy sessions.

The initial assessment of the long palmar and long flexor muscle strength of the thumb revealed a predominantly weak force (F2) in both study groups with 45% in group 1 and 47.4% in group 2), the patients being able to mobilize the segment only by eliminating the gravity, and 55% of patients in group 1 and 52.6% of patients in group 2 initially showed a force that moved the segment along its entire amplitude against gravity (F3), yet, not maintaining it over time. After one month of physiological treatment, there was a considerable decrease in patients with weak muscle strength, only 3 (7.5%) patients in group 1 and 2 (5.2%) patients in group 2 and an increase in the number of patients with antigravity force, viz. 26 (65%) patients in group 1 and 22 (57.8%)

patients in group 2. Noteworthy is the presence of good strength (S4) of complete mobilization of the segment against resistance in 16 (27.5%) patients from the 1st group and in 14 (36.8%) patients from the 2nd study group. The increase in muscle strength in the groups was determined by both active kinetotherapy and selective occupational therapy exercises.

4.2. Data assessment of rheumatoid arthritis via clinical instruments in both study groups.

Dynamic assessment of pain intensity was performed by Visual Analogue Scale of Pain (VAS) - graded from 0 to 100 mm, where 0 means no pain, and 100 corresponds to the most severe pain. Thus, the dynamics of pain manifestations was reported during the study; the results are shown in Figure 5.

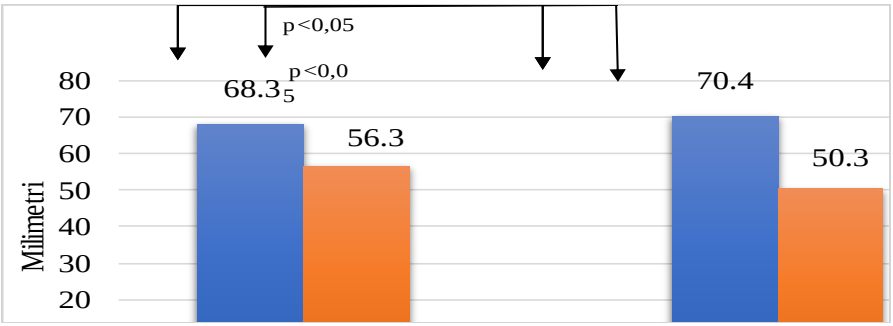

Figure 5. **Pain intensity dynamics assessed in both groups according to the VAS scale.**

The mean pain intensity at initial testing was 68.32 ± 3.16 mm (i.e. 50-89) in group 1 (p <0.05) and 70.41 ± 3.13 mm (i.e. 51- 92)) in group 2 (p <0.05), for both groups, being classified as moderately severe pain. After a month of functional treatment, a decrease in the mean pain value to 56.28 ± 2.14 mm (iv. 45-67) was observed in group 1 (p <0.05) and 50.26 ± 2.18 mm (iv. 36-61) in a group. Group 2 (p <0.05) was assessed as moderate pain. Comparative analysis between groups showed a decrease in pain in both groups, but the intensity regression was more pronounced in patients who underwent a combined program of kinetic exercises with occupational therapy sessions.

The global impact of the disease was assessed by the patient's self-assessment via Patient Global Assessment (PGA) the same way as the pain assessment, via an Analogue Visual Scale assessed in dynamics. Thus, the patients in group 1 self-assessed their overall health as being 65.35 ± 11.5 mm (iv.38-92) at the study entry (p <0.05), and then 53.47 ± 9.78 mm (iv. 32-64) (p <0.05) after one month of active kinetic treatment. The patient overall health in group 2 was self-assessed by 63.47 ± 12.3 mm (iv.37-89) (p <0.05) at the beginning of the study (T1), and decreasing to 43.26 ± 8.41 mm (iv. 28-54) (p <0.05) over a month of treatment in this group.

Data analysis showed that the overall health improved significantly in both groups, namely, in those who underwent the traditional rehabilitation program and in patients who had a rehabilitation program combined with occupational therapy. However, patients from the 2nd group self-assessed their overall health as good (28 mm) over a month of treatment, a fact which was not reported by the patients from the 1st group.

The comparative assessment of mean MDGA values at time T1 between groups showed no statistically significant differences (p> 0.05), the mean score being close to 57.67 ± 12.54 mm and 55.52 ± 9.3 mm in group 1 and 2, respectively. One month after the treatment completion, the MDGA value was statistically significantly higher in group 1 compared to group 2 (48.14 ± 8.51

mm versus 38.21 ± 8.24 mm, p <0.05), which indicates a satisfactory condition in group 1 vs. a good one in group 2.
The study results show lower values of the physician global assessment of the patient (MDGA) compared to the patient's self-assessments (PGA). It can be concluded that patients underestimated their overall health.
The dynamic assessment of the degree of disability was carried out according to the Rankin scale (Figure 6).

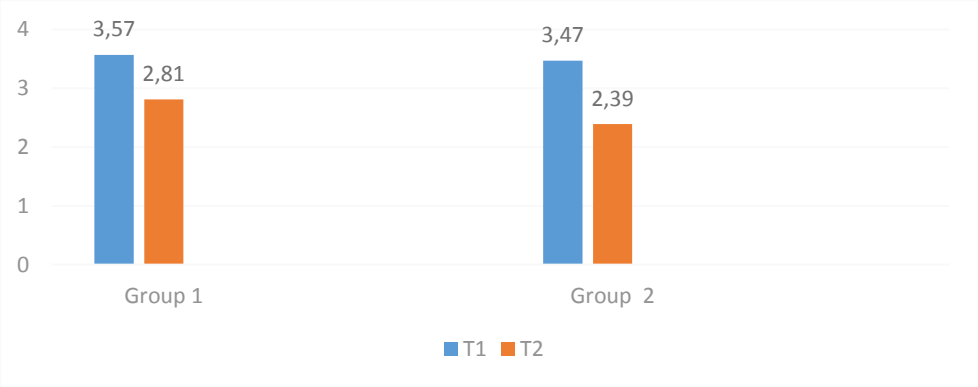

Figure 6. **Dynamic assessment of disability in both study groups.**

Over one month of active physiological treatment, the mean tested value decreased to 2.81 ± 0.6 points (p <0.05), indicating a predominance in group 1 of patients with moderate disabilities. Thus, 31 (77.5%) patients were assessed with moderate disability (Grade III), 6 (15%) patients with mild disability (Grade II) and 3 (7.5%) patients maintained a severe disability (Grade IV).
Over one month of physiological treatment combined with occupational therapy there was only one (2.6%) patient with severe disability (Grade IV) in group 2, 11 (28.9%) patients were assessed with mild disability (Grade II) and 26 (68.5%) patients were assessed with moderate disability (Grade III).
Systematic performance of functional recovery exercises reduced disability in both groups; however, a greater number of patients with mild disabilities from group 2 confirms the effectiveness of combining physiotherapy with occupational therapy sessions.
The assessment of daily activities via the HAQ questionnaire showed a decreased score from 1.92 ± 0.39 to 1.23 ± 0.43 in group 1 (p <0.05) and from 2, 06 ± 0.61 to 0.925 ± 0.68 for group 2 (p <0.05), due to an improved joint functionality at the end of treatment.
The use of the HAQ questionnaire for patients with rheumatoid arthritis made it possible to separately quantify self-care activities, instrumental activities, and productivity, work and leisure activities. Thus, patients undergoing conventional treatment (group 1) showed an increased functionality of daily activities in terms of self-care, such as personal hygiene, cooking, serving food, using the toilet, dressing and undressing.
Only 5 (12.5%) of the patients stated as *I do it with great difficulty*, 27 (67.5 %%) patients said *I do it with difficulty* and 8 (20%) patients reported as *I do it with no difficulty*.
The comparative assessment of the life quality parameters in study group 1 showed the improvement of physical functions from 36.6 ± 8.3 to 38.2 ± 7.6 (p> 0.05) conventional points, of the physical role from 38, 9 ± 5.1 to 39.5 ± 5.3 (p> 0.05) and of the physical status from 27.5 ± 4.3 to 38.3 ± 4.2 (p> 0.05) points. The distribution of quality of life indicators in group 2 shows a

positive dynamics of pain from 30.5 ± 2.3 to 53.3 ± 2.8 (p> 0.05) conditional points, of physical functions and the role of physical functions from 38.2 ± 5, 1 to 52.12. ± 4.7 (p> 0.05) and from 41.3 ± 7.3 to 53.3 ± 7.1 (p> 0.05), respectively, as well as the value of the overall physical activity increased from 26.7 ± 4 , 1 to 54.1 ± 4.3 (p> 0.05). Thus, the quality of life of patients in this group has improved both emotionally and mentally, physical and functional characteristics being increased as well.

4.3. Patient's compliance with treatment in study groups.

The major goals of a successful physiological treatment, improved joint function, increased muscle tone and hand skill recovery can only be achieved by increasing the patient's adherence to treatment. Compliance with the treatment regimen involves a mutual cooperation between the patient and the rehabilitation team, as well as a conscious participation during each physiotherapy session. This patient's behavior to comply with the treatment and follow the medical recommendations is defined as compliance, being also referred as adherence. We assessed the patient's adherence to standard treatment in combination with an occupational therapy program. (Figure 7).

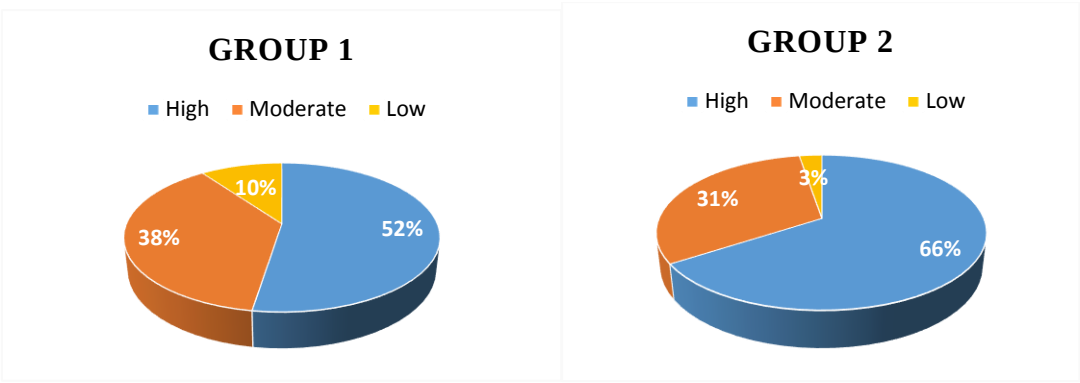

Figure 7. Patient's adherence to treatment in both study groups.

Thus, by using the MORISKY-8 treatment adherence questionnaire, we found that 21 (52.5%) patients from group 1, who underwent conventional treatment, showed high-level adherence, however, 4 (10%) patients had a low and 37.5% (n 15) moderate adherence. Patients with low compliance after being discharged, skipped some days of treatment or reduced the amount of exercise feeling disturbed by physical activity. The systemic analysis of group 2 patients highlighted the more orderly involvement of patients in the program. Thus, 25 patients (65.79%) complied to the program and accumulated 0 points according to the applied questionnaire. Only 1 patient missed 2 days of the physiological program due to morning stiffness.12 patients (31.58%) reduced the amount of exercises, thus, being included in the group of patients with mean adherence to treatment.

4.4 Algorithm for clinical-functional evaluation and patient's rehabilitation with rheumatoid arthritis

The rehabilitation approaches for people with rheumatoid arthritis include joint protection, exercise and self-management strategies. Physio -functional active methods provide an increase in self-confidence, high-level of independence in various activities, reintegration into the family, social and professional involvement, thus offering the patient a complete psychosocial status.
The analysis of the results obtained made it possible to develop an algorithm for the functional rehabilitation assessment of the patient with rheumatoid arthritis (Figure 8).

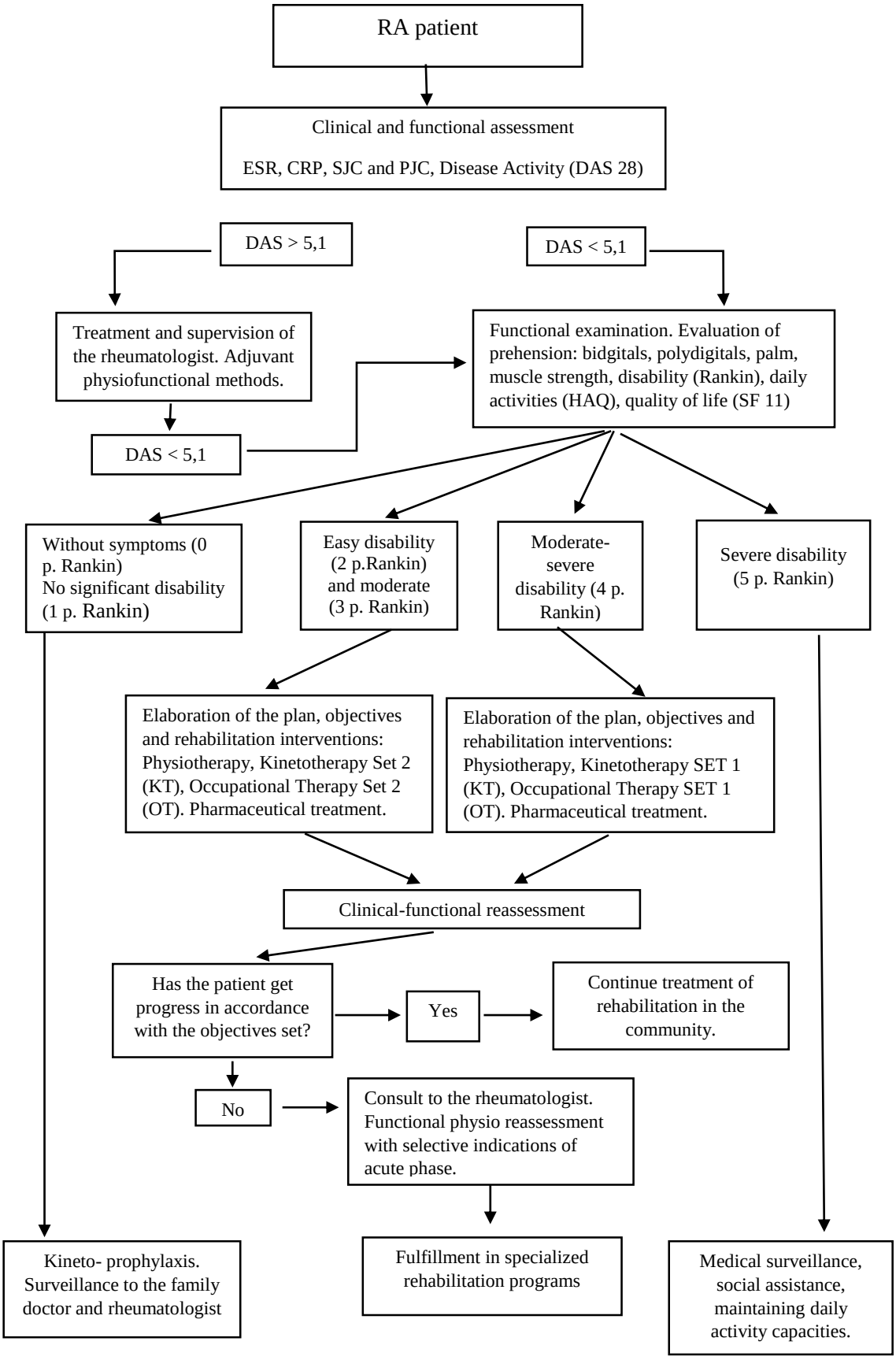

Figure 8. **Algorithm for clinical and functional evaluation and patient's rehabilitation with rheumatoid arthritis.**

Rheumatoid arthritis (RA) is an intermittent or progressive chronic disease, characterized by progressive joint impairment, disability, and poor quality of life. Therefore, patients undergo various treatments throughout their lives. An important component of successful disease management is patient education and awareness of planned treatments [18]. Rehabilitation associated with pharmacological and surgical treatment of patients with rheumatoid arthritis aims at minimizing the consequences of the disease. A structured approach to the management of rehabilitation is required for a systematic assessment of the consequences of the disease, as well as an adequate definition and assessment of the therapeutic and interventional objectives in cooperation with the patient [19, 20].

Rehabilitation approaches for people with rheumatoid arthritis include joint protection, exercises, and self-management strategies. The active physiofunctional methods provide an increase in self-confidence, high -level of independence in various activities, reintegration into the family, social and professional integration, thus offering a complete psychological and social condition of the patient.

Physiofunctional rehabilitation treatment of people with rheumatoid arthritis requires the development of kinetic and occupational activity programs depending on the degree of functional disability and disease activity.

Occupational therapy ensures the involvement, engagement, motivation and successful participation of each person. The active physiological treatment is preceded by assessing occupational activity and gesture disorders, the muscle strength involved in gripping, the activity of the rheumatoid process, as well as an assessment of daily activity, the quality of life and the degree of disability. The physiological program is complemented by occupational therapy methods that eliminate or compensate for disorders, contributing to the restructuring of impaired movement patterns. Rehabilitation by active physiotherapy and occupational methods might facilitate an active lifestyle for rheumatoid patients by adapting to psychosocial and physical environment due to improved functional performance.

GENERAL CONCLUSIONS

1. The analysis of clinical and functional characteristics of the studied patients with rheumatoid arthritis revealed the predominance of pain syndrome (averaged as 69.26 ± 9.76 mm via VAS scale) associated with the development of moderate functional disability (averaged as 3.52 ± 0.11 via Rankin scale).

2. Depending on the disability degree and disease activity, individual programs for physiological rehabilitation of patients with rheumatoid arthritis were developed that combined kinetotherapy and occupational therapy.

3. The rehabilitation programs designed according to the degree of disability and disease activity, including both physical therapy and occupational therapy significantly improve the functional and psycho-emotional parameters in patients with rheumatoid arthritis (averaged as 0.92 ± 0.51 via HAQ scale).

4. The use of active kinetotherapy and occupational therapy in the rehabilitation program significantly increases the positive dynamics of general functional parameters (fine and power grip) of the hand in patients with rheumatoid arthritis (two-finger grip 4.34 ± 0.76, palm grasp 2, 18 ± 0, 78).

5. The study revealed a significant improvement in the quality of life due to the physical and mental component (according to the SF 11 scale) in patients with rheumatoid arthritis who underwent active physiotherapy and occupational therapy compared with the conventional recovery treatment (60.89 ± 2 ,19- physical condition, 72.12 ± 2.65 -mental status).

RECOMMENDATIONS

1. To optimize the rehabilitation treatment of people with rheumatoid arthritis; a complex clinical and functional assessment is recommended by using DAS 28 index, VAS scaling, as well as the assessment of two-finger grip, three-finger grip ,palmar grasp , muscle strength , daily life activity by HAQ scale , quality of life (SF 11 scale) and disability via the Rankin scale.

2. To optimize medical rehabilitation programs for RA patients; an improvement of the conventional treatment with active occupational therapy is recommended.

3. Complex assistance of RA patents should be focused on the principle of rehabilitation continuity of treatment, involving secondary kinetoprophylaxis programs at home.

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