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# Sequencing Exercise Program of Reumatoid Arthritis

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# 류마티스 관절염 환자의 단계별 운동

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Goals of Rheumatoid Arthritis Management

1. Pain control
2. Improvement of altered biomechanics
3. Improvement and maintenance of strength, endurance and range of motion
4. Improvement of self image and adjustment to disability

Physiatrist in Rhematoid Arthritis Management

1. Recognize that the program should be home-based, materials used should be simple and inexpensive, and it should be flexible as to timing for not interfering patient's life.
2. Books or written programs of prescribed exercise are less desirable than program tailored to the problems and specific needs of patient.
3. For managing pain, use of full dose anti-inflammatory or analgesics medication supplimentary by physical agents.
4. Criterion for use of any modality is whether it reduces pain or not. "Respect for pain"
5. Patient should be told that the purpose of physical modality is to temporarily decrease pain to allow them to move their joint or to proceed to the next step.

Functional Assessment

* Manual muscle testing
* Sensory evaluation
* Location of pain, heatness and inflammatory joints, tendon rupture, crepitus, nodules, subluxations or dislocations
* Two generations of functional assessment

1. ambulation, self-care and other activity of daily living
2. psychological, social, and vocational function

* 가톨릭대학교 의과대학 조교수

* Uses and Purposes of Functional Assessment Instruments for Arthritis

| Instrument | Uses and Purposes* | | | | |
|---|---|---|---|---|---|
| | Description | Screening | Assessment | Monitoring | Prognosis |
| Arthritis Impact Measurement Scales(AIMS), Meenan et al., 1980 | | P, E | P, I | | P, I |
| Classification of Functional Capacity, American Rheumatism Association(ARA), Steinbrocker et al., 1949 | P, E | P, E | | P, E | P, E |
| Stanford Health Assessment Questionnaire(H.A.Q.), Fries et al., 1980 | P, E | P, I | p | P, I | P, I |
| Functional Status index (F.S.I.), Jette, 1980 | P, I | P, I | | P, I | P, I |
| Functional Index, Lee et al., 1973 | P, E | P, I | p | P, I | |
| Assessment of Function, Ehrlich, 1973 | | | P, I | | |
| Index of ADL, Katz et al., 1963 | P, E | P, E | P, E | P, E | P, E |
| Polyarticular Index, Convery et al., 1977 | P, E | P, I | P, I | P, I | P, I |
| Brief Objective Evaluation of Functional Ability, Swezey(21), 1978 | P, I | P, I | | P, I | P, I |
| Rheumatic Disease Self-Assessment of Function, Swezey(21), 1978 | | P, I | | P, I | |

* Symbols used : P=primary purpose ; E=established use ; p=possible other purpose ; I=intended use.

* Ultimate goal-to assess status according to variables that together define how an individual function within society

# an outlines of major uses and purposes for functional assessment instruments

1. description
2. screening
3. assessment
4. monitoring
5. prediction

Rehabilitation Treatment Plans must be

1. Individuaized
2. Begin early
3. With rationale
4. Periodic reevaluation

Applicable Modalities of RA

1. Education
2. Physical therapy
3. Occupational therapy

4. Vocational therapy
5. Medication
6. Surgical intervention

Component of Physical Therapy in Arthritis

Physical modalities : Heat
Cold
Water
Electricity
Hydrotherapy
Force(traction, massage)

Therapeutic exercise : Range of motion
Strengthening
Enduarnce
Relaxation
Breathing

Motor training : Gait
Transfer and mobility
Body mechanics
Posture
Muscle reeducation

Patient education : Joint protection
Home programs

EXERCISE IN ARTHRITIS

Goal of Exercise

1. Prevent deficit of strength, joint motion, endurance and maintain it.
2. Improve well-being, social interaction, and ADL capacity.
3. Increase bone density, and decrease pain by improving biomechanical advantages.
4. Exercise should be designed in a manner that minimize joint irritation and pain.

Effect :

1. Increase and maintain ROM
2. Reeducation and strengthen muscle
3. Increase static and dynamic endurance
4. Joint to function better biomechanically
5. Increase bone density
6. Improve patient's overall function and well-being

Consideration :

1. Degree of joint inflammation
2. Machanical derrangement
3. Presence of joint effusion
4. Condition of surrounding musculature
5. Patient's overall level of endurance
6. Condition of cardiorespiratory system
7. Patient's attitude

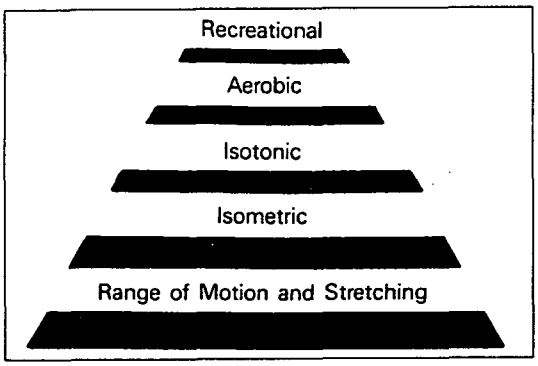
Certain Esssential Principles :

1. Appropriateness for patient's ability and pain tolerance
2. Clarity of objectives of exercise program
3. Proper design to improve function
4. Provision of positive information to patient
5. Production of some but not undue amounts of fatigue

Steps : Sequencing Exercise Programs

1. start with relieving pain of involvement joints with approprioate modalities
2. improve ROM by stretching and an active or active-assistive ROM program
3. increase muscle tone by muscle reeducation
4. increase the static strength and endur-

ance of muscle by isometric exercise
5. introduction of an isotonic exercise program
6. finally recreational exercise




Bardwick and Swezey(1982)
1. no exercise be prescribed for acute-severe phase
2. acute-mild/moderate phase ; 1-3 stretches of each muscle group
   1 or 2 times per day, I isometric exercise/muscle group/day
3. subacute-moderate phase ; warm water swimming, 3 to 10 stretches session once or twice a day, two isometric strengthening sessions per day
4. subacute-mild ; 5-10 stretches I to 5 per day, 2 isometric and 1 isotonic session per day

Ability to Exercise
1. Class I ; any type of exercise exception hard physical exercise e. g. running, individual racket sports
2. Class II and a few class III in low activity phases ; most type of exercise(cycling, walking, jogging)
   high activity phases ; no load or very low loads e. g. a cycle ergometer
3. Class III ; swim or exercise on bicycle
4. Class IV ; quite a few patient some physical activity e. g. supportive in water

Rule of thumb 'DO NOT EXERCISE'
1. severe pain at the exercise time
2. post-exercise pain lasting more than 1-2 hours
3. undue fatigue
4. increased joint inflammation or excessive pain on the day following exercise regimen

Exercise Prescription
1. Specific advise about purpose of exercise
2. Specific type of exercise to be used
3. Joint in which exercise is to be used
4. Frequency of each exercise
5. Length of time each should be used
6. Precaution or monitoring

Exercise Program Reevaluation
1. Status of disease activity
2. Condition of joint
3. Whether goals are being met or not
4. Determine if the program should be advanced

General Description of Exercise in RA Patients

1. Acute stage
   Aims of treatment : a. relief of symptoms
   b. improvement of patient's general health
   Rest joints or joints as close to position of function

* Recommended joint position for immobilization

| Joint involvement | position of joint |
|---|---|
| jaw | I inch open |
| neck | in physiologic lordosis |
| shoulder | abduction 45°, 30−45° flexion |
| elbow | not be flexed beyond 75 |
| wrist | |
| dominant side | 20° extension |
| nondominant side | neutral or slightly flexion |
| fingers | 35−45° flexion at MCP joints |
| | 25−30° flexion at PIP joints |
| | 15° flexion DIP joints |
| thumb | abduction with IP joint flexed at 20° |
| | halp opposed |
| hip | 45° abduction, flexed no more than 5° |
| knee | fully extended position |
| ankle | 90° flexion |
| feet | neutral |

ROM exercise and static isometric exercise after a period of high disease activity

2. Subacute stage
   ; joint condition will appearance to be settled
   overindulgence in joint strain
   movement is followed by a flare up of the arthritic symptoms

Main aims of treatment
1. maintenance of general health
2. prevention of further exacerbation
3. commencement of correction of deformity

Superficial heat modalities apply
Excercise−balancing rest and exercise
phase 1 ; in bed receiving both active assistive ROM exercise and isometric exercise
phase 2 ; tought to get into a chair at the bed sole
continuous exercise and increase deration of period gradually
phase 3 ; standing exercise
phase 4 ; walking with walker or manual assistance
phase 5 ; progress in walking with the assistance of crutches
phase 6 ; cane ambulation
full weight bearing−necessary to support the knee and
ankles with bandages and splints
Introduction of energy conservation, joint protection and work simplification methods

3. Chronic stage
   ; a vicious circle of joint pain and muscle spasm and immobility in the joints deformity
   Gentle stretching exercise
   Dynamic, repetitive, low−resistence isotonic exercise
   Ambulatory aids
   Education and vocational rehabilitation

## EXERCISE PRESCRIPTION IN RA

### 1. Rest

Consideration point of rest
Patient should be cautioned to avoid both physical and mental exhaustion.
Rest should be prescribed to ensure minimum level of general and local joint fatigue.
For very active generalied RA, 8 hr bed rest at night, 1 hr nap in the daytime.

* Fitwss Deterioration Caused By Specific Stresses

| FUNCTION | SEMISTARVATION | THIAMINE DEFICIENCY | RED REST | ACUTE STARVATION |
|---|---|---|---|---|
| Speed | | | | |
| Hands | * | | | *** |
| Arms and hands | * | * | | ** |
| Body and arms | * | *** | | *** |
| Coordination | | | | |
| Number | ** | *** | | * |
| Time | * | *** | | * |
| Strength | | | | |
| Grip | *** | | | |
| Back | *** | | | |
| Endurance | | | | |
| Time | *** | * | *** | *** |
| Max $O_2$ | *** | | *** | |
| Walking | | | | |
| Skill | | | | * |
| Pulse | | *** | *** | |

*=slight ; **=moderate ; ***=marked.

During rest : firm mattress, flat pillow, frequent prone position, avoidance of pillow under knee

Psychic rest

Prolonged rest causes demineralization of bone, loss of muscle protein, cardiovascular deconditioning.

Type of rest

1. Systemic rest /Bed rest : Hospitalization for 4 weeks−optimum
   Muller, 1970 : muscle strength decline, only 3% a week
2. Local rest:reduce pain and imflammation rest for joint for 2 weeks−Do not cause LOM, Delisa
3. Short rest period : more wisely accepted
   Rest vs. activities(Gerber, 1987)
   Number of rest over 1. 5 hr−decrease
   Number of rest break for activities continuing over 0. 5 hr−increase
   Number of rest−activity cycle−increase

2. Range of motion(ROM) exercise and stretching

1) Active ROM exercise−initiated when joints become less acutely inflammed
   −Preserve and increase joint motion
2) Passive ROM exercise or gentle active−assistive ROM exercise
   −More joint inflammation than isometric exercise
   −Limited use : once or twice a day to avoid motion loss
3) Stretching
   −Time to exercise : Patient at his or her best, late morning and early afternoon

- with exercise : moist heat or cold, supplementary analgesics
- According to disease activity

a) When severe joint inflammation and pain :
   - goal of therapy : minimize further loss of ROM
   - Active & gently assisted exercise with 1-3 gentle repetition once or twice

b) As severity of inflammation decreased : restore joint mobility, preserve it.
   - 3-5 times with initial repetition as 'warm up',
   - final 2-3 times as actual stretching just into range of pain
   - severe joint destruction, subluxed or dislocated joint : No exercise restore LOM or aligment.
   - Malalignment of joint due to contracture alone and not excessively demaged : reasonable restoration of LOM is possible

* Example of ROM exercise(Arthritis Foundation, 1997)
   - Set reasonable goals.
   - Find a buddy who is willing to exercise with you.
   - Do these exercises once or twice per day.
   - Do each exercise three to 10 times.
   - Move slowly. Do not bounce.
   - Breathe while you exercise. Count out loud.
   - STOP exercising if you have severe pain. Don't overdo it.

Check with your doctor before beginning any exercise program.

*** Minimal Joint ROM for Function**

| | |
|---|---|
| Shoulder | 0-75° flexion /abduction<br>45° internal rotation |
| Wrist | 0-20° extension<br>0-20° flexion<br>0-60° pronation<br>0-60° supination |
| Metacarpal-phalangeal | 0-70° flexion |
| Proximal interphalangeal | 0-90° flexion |
| Hip | 0-30° flexion<br>25° extension rotation |
| Knee | 0-60° flexion |
| Ankle | 5° dorsiflexion to 15' plantar-flexion |
| Neck | 0-30° flexion /extension / side bending<br>0-45° rotation |

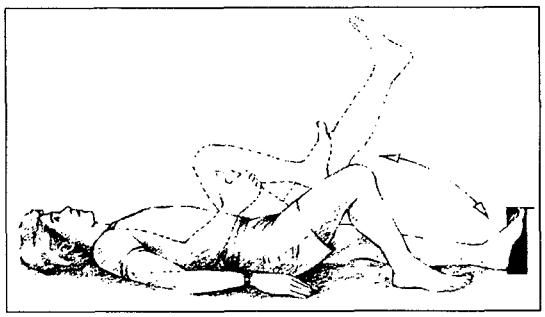


FIGURE 1. KNEE AND HIP

Lie on your back with one knee bent and the other as straight as possible. Bend the knee of the straight leg. Use your hands to pull your knee to your chest. Push the leg into the air and then lower it to the floor. Repeat, using the other leg. If you feel poin in your knee, do not kick it into the air. just lower it to the floor.

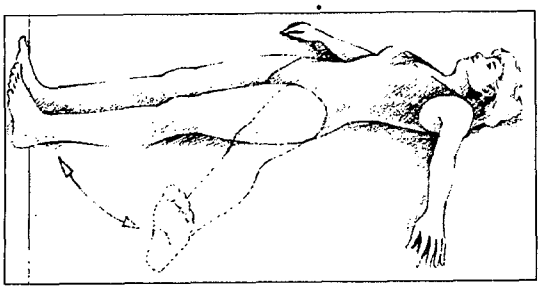


FIGURE 2. HIP

(This exercise is not recommended for people who have had total hip replacements, who have low back problems or who have osteoporosis.) Lie on your back with your legs straight and about six inches apart. Point your toes up. Slide one leg out to the side and return. Try to keep your toes pointing up. Slide your leg only. Do not lift it. Repeat with your other leg. This exercise also can be done from a standing position.

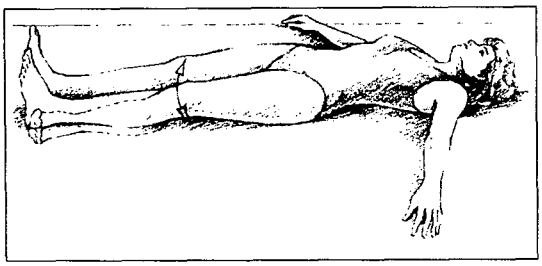


FIGURE 3. HIP AND KNEE

Lie on your back with your legs as straight as possible, about six inches apart. Keep your toes pointed up. Roll your hips and knees in and out, keeping your knees straight. To further strengthen knees, while lying with both legs out straight, attempt to push one knee down against the floor. Tighten the muscle on the front of the thigh. Hold this tightening for a slow count of five. Relax. Repeat with the other knee.

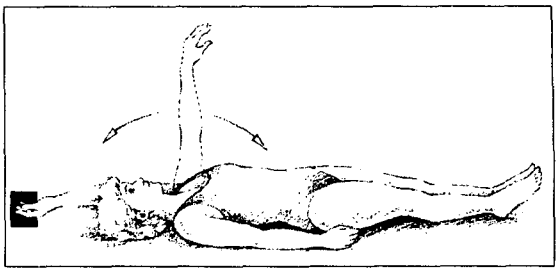


FIGURE 4. SHOULDER

Lie on your back. Raise one arm over your head, keeping your elbows straight. Keep your arm close to your ear. Return your arm slowly to your side.

Repeat with your other arm.(This exercise also can be done from a standing position.)

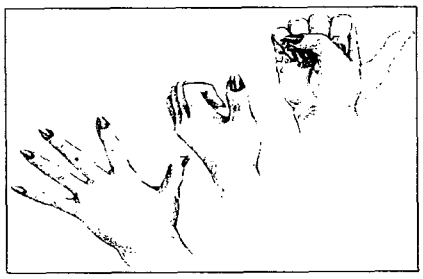


FIGURE 5. FINGERS

Open your hand, with fingers straight and spread apart. Bend all the finger joints except the knuckles.

Touch the top of your palm with your fingertips. Reach thumb across palm until it touches the second joint your liffle finger. Stretch your thumb out and repeat.

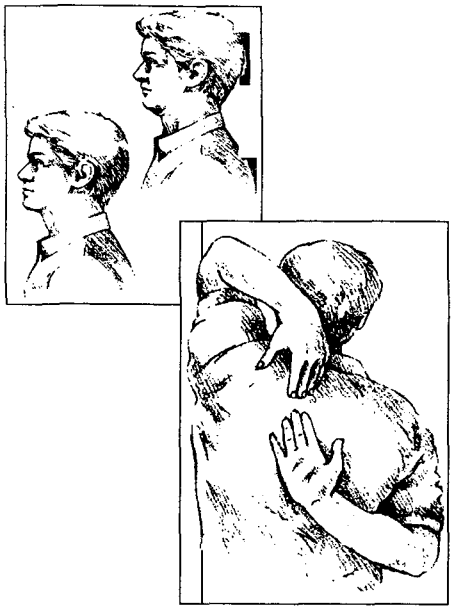


FIGURE 6. CHIN AND NECK

Pull your chin back as if to make a double chin. Keep your head straight—don't look down. Hold for three seconds. Then raise your neck straight up as if someone were pulling straight up on your hair.

FIGURE 7. BACK

Reach one palm over your shoulder to pat back and place the back of your other hand on your lower back.

Slide hands toward each other, trying to touch fingertips. (Note : Many people are not able to actually touch their fingertips together.) Alternate arms.

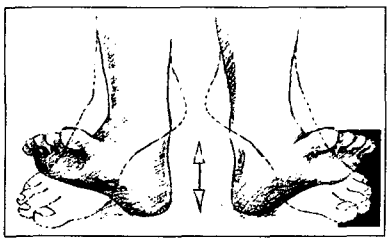


FIGURE 8. ANKLE

While sifting, lift your toes as high as possible. Then return your toes to the floor and lift your heels as high as possible. Repeat.

3. Isometric exercise

—most suitable exercise in RA patient ; minimally or moderately active joint disease

—Least shear force across joint, intraarticular pressure and juxtaarticular bone destruction

—one 6 sec isometric exercise per muscle group once or twice daily

—BRIME(Brief Isometric Exercise)

1—6 contraction, each held for 3—6 sec with 20 sec rest

It can increase muscle strength and endurance without significant BP rises.

—Simple method for performing iosmetric exercise using elastic band

4. Isotonic exercise

Two main types

1) Delorme method

—high resistive, low repetition method

—muscle hypertrophy, but large forces across joint

2) Delateur method

—constant low weight with repetitions just to the point of muscle fatigue

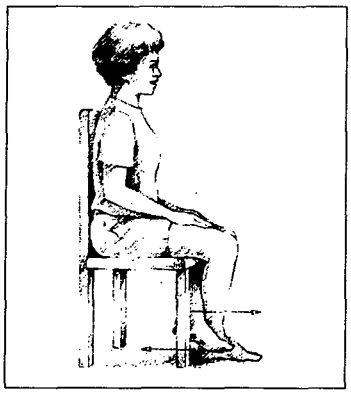
—recommendable for arthritis

—modified for RA patient

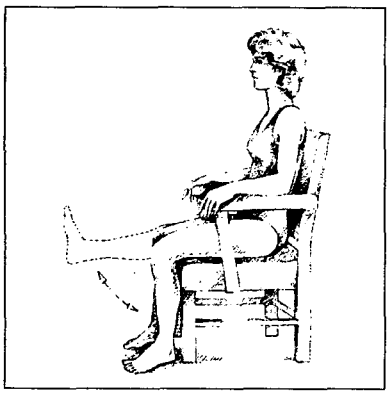
—low resistance and a few repetitions after pain and joint inflammation have been controlled and sufficient strength has be attained by isometric strengthening

—exercise course must be indivisualized

5. Isokinetic exercise—not recommended



Isometric exercise



Isotonic exercise

6. Endurance exercise

- Suitable aerobic exercise for increasing endurance : Low impact aerobics, swimming, bicycle ergometry, or walking
- initially, duration must not be greater than 5 to 10 min. daily
- eventually, each exercise period should last about 40 to 50 min. and be divided into three components ; warm-up phase of 10 min of active ROM exercise a phase of aerobic exercise lasting 20 to 30 min a cool-down period of 10 min involving gentle ROM

* Perlman(1987)

Combination of low impact aerobic exercise with a problem solving education program is synergistic

"can do" attitude is further developed and reinforced during education session

- Recommened exercise program

low level ergometry program at 70% maximal heart rate done 3 times a week starting in progressive intervals as low as 5 to 15 min for 12 week period

- Training heart rate in a program ; 60-80% of maximal heart rate

If deconditioned, begun on 60% of maximal heart rate

eg) 30 years old, resting heart rate 70 /min, training heart rate 60%($VO_2$ max level)

=% of target heart rate /100×
(Maximal HR-Resting HR)
+ Resting HR

=0.6×(190-70)+70=142

6. Recreational exercise

- Advantages : keep biomechanical benifit, provide social contact, increase social esteem. antidepressant effect.
- Amount of exercise ; depend on person's interest, communication resources, stage of arthritis
- started only after ROM, strenghtening, and endurance activities have been instituted
- swimming in heated pool

Good for RA : swimming, dancing, walking, cycling, low impact aerobics, gardening

Bad for RA : running, fast walking, high

* Joint-Disability /Exercise-Compatible Training Programs

| DISABLED JOINTS | ENDURANCE TYPE 1 MUSCLE TRAINING | POWER TYPE 2 MUSCLE TRAINING |
|---|---|---|
| Upper extremity | Swimming<br>Running<br>Water running<br>Cross country skiing machine<br>Water treadmill<br>Hiking<br>Walking<br>Stationary bicycle | In joints with limited motion, isometric exercises for all para-articular muscle groups<br>All unaffected joints, customized complete-resistance isotonic and isokinetic exercises<br>Customized program for each involved joint, maintaining strength with low or no impact on joint |
| Back | Swimming<br>Water running | Lifting in supine or prone position<br>Avoiding loading of spine ; (i.e., lifting weights in the vertical [standing] position) |
| Lower extremity | Swimming<br>Upper extremity<br>Cycle ergometer<br>Water running<br>Low-impact walking may be possible<br>Cross country skiing machine | Severely restricted joints, isometric exercises<br>All other joints, customized isotonic and isometric exercise program to tolerance level* |

* "To tolerance" means that no pain is experienced during exercise performance, and no effusions or pain that can be directly attributed to a specific exercise occur within 24 hours of exercise completion.

impact aerobics, tennis, contact sports

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