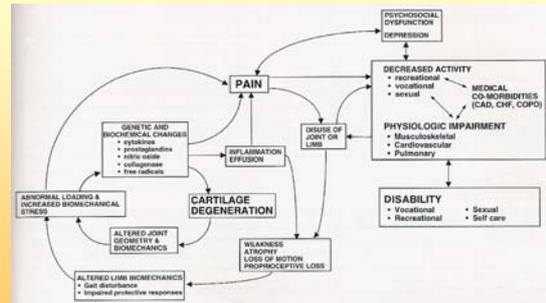


The role of Physical Medicine and Rehabilitation in the management of Osteoarthritis

Yannis Dionyssiotis, MD, PhD, FEBPRM
Physical Medicine and Rehabilitation Physician

Head of Rehabilitation Department, Rhodes General Hospital, Rhodes, Dodecanese, Greece
Research Fellow Laboratory for Research of the Musculoskeletal System, University of Athens, KAT Hospital, Kifissia, Greece

Model of multifactorial process of degeneration, pain, psychosocial and physiologic dysfunction and disability that may occur in osteoarthritis



Frontera WR. and Silver JK., Essentials of Physical Medicine and Rehabilitation Philadelphia, Pa, Hanley & Belfus 2002, ISBN 1-56053-443-5

The management of OA

- Physical examination
- Functional limitations
- Diagnostic studies
- Differential diagnosis
- Treatment

Physical examination

- Joint examination
 - Neuromuscular examination
- Examine joint status and also evaluate the state of the disease.
 - Assess more closely the musculoskeletal status by examining posture, gait, Range Of Motion, muscle strength
 - Muscle atrophy, weakness, proprioception

- Subjective joint pain, function, and health-related quality of life have been evaluated using several questionnaires, such as the Lequesne Indices of Severity for Osteoarthritis of the hip and the Western Ontario and McMaster Universities (WOMAC) OA index.(1,2)
- Stiffness may be estimated by measuring the range of motion (ROM) of the joints.

1. Lequesne MG, Mery C, Samson M, Gerard P. Indexes of severity for osteoarthritis of the hip and knee. Validation--value in comparison with other assessment tests. Scand J Rheumat Suppl 1987;65:85-9.
 2. Bellamy N, Buchanan WW, Goldsmith CH, Campbell J, Stitt LW. Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. J Rheumatol 1988;15:1833-40.

Functional performance tests

- Marching on-the-spot and walking up and down stairs are the most reproducible physical functioning tests and thus those can be recommended for use for patients with hip OA.(1)
- Trendelenbourg test
- Knee bendings/30 s and one-leg hop for distance (2)

1. Arokoski MH, Haara M, Helminen HJ, Arokoski JPA. Physical function in men with and without hip osteoarthritis. Arch Phys Med Rehabil 2004;85:574-81.
 2. Bremander AB, Dahl LL, Roos EM. Validity and reliability of functional performance tests in meniscectomized patients with or without knee osteoarthritis Scand J Med Sci Sports. 2007 Apr;17(2):120-7.

Functional limitations

Functional limitation	% of total patients
Difficulty walking long distance	41.8
Difficulty climbing stairs	9.3
Difficulty standing up from sitting	18.0
Pain disturbs sleep	5.4
Difficulty squatting	25.5
Needs Assistive device to walk	6.0

➤ Degeneration in the shoulders-hands
 Limit vocational and recreational activities, Grooming, eating, ADL

➤ Spinal degeneration results in limitations with all mobility

Akinpelu AO et al. Pattern of Osteoarthritis Seen In Physiotherapy Facilities AJBR, Vol. 10 (2007); 111 - 115

DESCRIPTION OF QUALITY OF LIFE SCORES (SF-12) IN THIS STUDY AND OTHER STUDIES FOCUSING ON OSTEOARTHRITIS

	PCS		MCS		Age	
	Mean	(SD)	Mean	(SD)	Mean	(SD)
Current study (Jakobsson & Hallberg)	34.2	(11.2)	51.1	(11.4)	82.0	(5.6)
Osteoarthritis (Clark et al., 1998)	31.2	(10.3)	47.7	(13.4)	66.0	(22-90) ^a
Osteoarthritis of the knee (Shields et al., 1999)	30.4	(7.3)	56.1	(8.4)	64.5	(10.4)
Osteoarthritis of the hip (Shields et al., 1999)	27.5	(8.8)	55.3	(8.6)	55.4	(14.3)

^a Median age (range).

Note: PCS = physical component summary score, MCS = mental component summary score.

1 Older adults with osteoarthritis had significantly more pain and functional limitations than those without osteoarthritis. However, the degree of depressed mood did not differ significantly between the two groups.

2 Quality of life was found to be significantly lower in the physical component but not in the mental component among those with osteoarthritis, although quality of life was significantly associated with pain, functional limitations, and depressed mood in both groups.

Jakobsson U, Hallberg IR. Quality of life among older adults with osteoarthritis: an explorative study. J Gerontol Nurs. 2006 Aug;32(8):51-60.

Diagnostic studies

- Plain radiographs
- MRI (ruling out osteonecrosis)
- Joint fluid analysis (ruling out other arthritis)

Differential diagnosis

Treatment

- Initial
- Rehabilitation

Attention to four principles

- Avoiding drug toxicity
- Limiting physical disability
- Relieving pain
- Maximizing physical and psychosocial adjustment

Initial Treatment

- Medication
(NSAIDs, chondroitin, glucosamine, acetaminophen)
- If *depression* should be treated with non or pharmacologic interventions

The primary goals in the rehabilitation of patients with OA are to

- (1) educate patients on the disease process and joint preservation to prevent or decrease pain,
- (2) improve flexibility, and
- (3) increase static and dynamic muscle strength.

Sisto SA, Malanga G: **Osteoarthritis and Therapeutic Exercise** Osteoarthritis and therapeutic exercise. Am J Phys Med Rehabil 2006;85(Suppl):S69-S78.

Rehabilitation

Prevention and treatment of pain and disability through

- Counseling
- Education
- Adaptive equipment
- Encouraging weight loss

- Educate patients on the disease process and joint preservation to prevent or decrease pain.
- Education will also include emphasizing the benefits of a *regular* exercise program.
- Education is important to reduce stressful activity, such as stair climbing and the inappropriate use of an exercise bicycle (i.e., with the resistance set too high), and to explain the benefits of using a cane and controlling weight.
- For the obese patient, losing weight is essential for a satisfactory long-term outcome.
The Framingham Study has demonstrated that obesity is a causative factor in osteoarthritis of the knee in women.

Felson DT, Zhang Y, Anthony JM, Naimark A, Anderson JJ. Weight loss reduces the risk for symptomatic knee osteoarthritis in women. The Framingham study. *Ann Intern Med* 1992;116:53-9.

Rehabilitation

- Exercise
 - Although exercise can improve mobility, strength and endurance, overdoing it can aggravate symptoms (pain and inflammation).
- Superficial modalities
 - Ice has been shown to have more lasting benefit, but heat is often preferred by the patient.
 - This therapy is used before exercise; its purpose is pain relief.

The role of physical therapy

- Stretching program
- Positioning (to help patients reduce stress on joints or soft tissue during regular movement, work and recreational activities)
- Gait training (required to change poor habits, identify muscle weakness and imbalance and increase strength and walking range) and transfer training
- Aerobic and resistance exercises

Role of therapeutic exercise

1. Reduction of impairments
 - range of motion
 - strength
 - flexibility
 - endurance
2. Reduction of pain
3. Improve or maintain function
4. Protect joints from further damage
5. Prepare the individual to safely participate in more vigorous or prolonged physical activity

Minor MA. Exercise in the treatment of osteoarthritis. *Rheum Dis Clin North Am* 1999;25:397-415.

Overview of Comprehensive Exercise

- a comprehensive exercise program should involve exercises
 - that improve functional capacity first, with a secondary focus on physical fitness so that the patient may engage in activities of daily living without undue pain or fatigue.
 - Exercises should progress **from flexibility** of the affected joints to prevent joint contracture, **to strengthening** exercises focusing on functional tasks that enhance muscle endurance and contraction speed, **to aerobic exercises**, either weight bearing or non-weight bearing, such as aquatic exercise.
 - Initially, the exercise program should progress more conservatively to monitor symptom exacerbation indicating adaptability to increased physical demand, and also to encourage exercise compliance.

Sisto SA, Malanga G. Osteoarthritis and therapeutic exercise. Am J Phys Med Rehabil. 2006 Nov;85(11 Suppl):S69-78.
 Fisher NM: Osteoarthritis, rheumatoid arthritis and fibromyalgia. In *ACSM's Resources for Clinical Exercise Physiology: Musculoskeletal NINAHC*, American College of Sports Medicine Philadelphia: Lippincott Williams & Wilkins 2002;111-24

Contraindications to exercise by the osteoarthritis patient

Absolute	Relative
Uncontrolled arrhythmias	Cardiomyopathy
Third degree heart block	Valvular heart disease
Recent electrocardiographic changes	Poorly controlled blood pressure
Unstable angina	Uncontrolled metabolic disease
Acute myocardial infarction	
Acute congestive heart failure	

Exercise Prescription for Older Adults With Osteoarthritis Pain: Consensus Practice Recommendations A Supplement to the AGS Clinical Practice Guidelines on the Management of Chronic Pain in Older Adults American Geriatrics Society Panel on Exercise and Osteoarthritis JAGS 49:808-823, 2001

Training parameters

Exercise	Intensity	Volume	Frequency
Flexibility: static stretching			
Initial	Stretch to subjective sensation of resistance	1 stretch/key muscle group; hold position 5-15 sec	Once daily
Goal	Stretch to full range of motion	3-5 stretches/key muscle group; hold position 20-30 sec	3-5/wk
Strength: resistance			
Isometric	Low-moderate: 40%-60% MCV	1-10 submaximal contractions involving key muscle group; hold contraction 1-6 sec	Daily
Isotonic	Low: 40% 1 RM Mod: 40%-60% 1 RM High: > 60% 1 RM	10-15 repetitions 8-10 repetitions 6-8 repetitions	2-3/wk
Endurance: aerobic	Low-Mod: 40%-60% of $\dot{V}O_{2max}/HR_{max}$ RPE: 12-14 = 60%-65% $\dot{V}O_{2max}$ Talk test	Accumulation of 20-30 min/day	3-5/wk

NOTE: 1 RM = one repetition maximum (measurement of isotonic or dynamic strength); MCV = maximal voluntary contraction (measurement of isometric strength); RPE = rating of perceived exertion; HR_{max} = age-predicted heart rate maximum; $\dot{V}O_{2max}$ = maximal aerobic capacity (measurement of aerobic fitness).

Exercise Prescription for Older Adults With Osteoarthritis Pain: Consensus Practice Recommendations. A Supplement to the AGS Clinical Practice Guidelines on the Management of Chronic Pain in Older Adults. American Geriatrics Society Panel on Exercise and Osteoarthritis JAGS 49:808-823, 2001

Flexibility (range of motion) exercises

- Range-of-motion exercises should be carried out using a slow motion, with the joint as close to full range as possible without resistance or weight.
- The terminal stretch position should be held for 15-30 seconds.
- In hip OA, especially iliopsoas and rectus femoris and adductor muscles are shortened.
- The aim of the exercises is to maintain full hip extension and 30° degree flexion (1)
- Flexibility exercises should be done 5-10 times each, preferably daily but at least 3 times / week.



1. Hochberg MC, Altman RD, Brandt KD, Clark BM, Dieppe PA, Griffin MR, Moskowitz RW, Schnitzer TJ et al. Guidelines for medical management of osteoarthritis. Part I. Osteoarthritis of the hip. Arthritis Rheum 1995;38:1535-1540.

Strengthening exercises

- When there are inflamed joints, the muscle should be strengthened isometrically daily.
- The contraction should be no longer than 6 seconds and number of the repetitions should be up to 8-10 with 20 seconds of rest between contractions and about 40-60% of maximal voluntary contraction.



If the hip joint is not inflamed, then resistance training such as dynamic exercises can be used.

The average resistance of 40-60% of the maximum should be used in the repetitions. One set of 6-15 repetitions 2-3 times per week should be made, and fatiguing the muscle should be avoided.

American Geriatrics Society Panel on Exercise and Osteoarthritis. Exercise prescription for older adults with osteoarthritis pain: consensus practice recommendations. J Am Geriatr Soc 2001;49:808-823.

Dynamic training

is more useful for the person with OA

- A *dynamic* contraction both changes muscle length and moves the joint.
- Dynamic contractions are further classified as isotonic or isokinetic. *Isokinetic* muscle contractions are performed on sophisticated machines that apply variable resistance throughout the range of motion.
- An *isotonic* muscle contraction is characterized by variable joint speed exerted against a constant resistance.



- Isokinetic training, which has been studied in OA patients shows no significant advantages over isotonic strengthening programs. Therefore, from a practical standpoint, isotonic is the recommended form of dynamic strength training for OA patients. (1,2,3)
- Isotonic exercise closely corresponds to everyday activities, and strengthening isotonic muscle contractions therefore are recommended for OA patients.

1. Kohrt WM, Spina RJ, Holloszy JO et al. Prescribing exercise intensity for older women. J Am Geriatr Soc 1998;46:129-133.
 2. Stevenson ET, Davy KP, Seals DR. Hemostatic, metabolic, and androgenic risk factors for coronary heart disease in physically active and less active postmenopausal women. Arterioscler Thromb Vasc Biol 1995;15:669-677.
 3. Stratton JR, Levy WC, Cerqueira MD et al. Cardiovascular responses to exercise. Effects of aging and exercise training in healthy men. Circulation 1994;89:1648-1655.

Key Muscle Groups Targeted for Stretching and Strengthening Exercises

Head, neck	Extensors, flexors
Shoulder	Forward flexion, extension, abduction, adduction External and internal rotators Scapular retractors and depressors
Elbow	Extensors, flexors
Forearm, wrist	Pronators, supinators Wrist extension, flexors
Hand	Finger flexor, extensors Thumb adductor, abductors
Trunk, low back	Forward flexion, extension, side bending, rotation
Hips	Forward flexion, extension, abduction, adduction External rotation, internal rotation
Knees	Extensors, flexors
Ankle, foot	Dorsiflexors, plantar flexors Inverters, everters Toe flexors, extensors



Aerobic exercises

- Aerobic exercises may include swimming (aquatic exercises), walking, biking, skiing and dancing.
- The appropriate intensity of the exercise is determined by the OA symptoms (i.e. they must not exacerbate the joint symptoms) and it is recommended to use an age-predicted heart rate maximum.
- Exercise intensity should range between 50-60% of age-predicted heart rate maximum.
- The frequency of the training should be for 30-60 minutes 3-5 times per week.
- *High-impact aerobics such as jogging and stair climbing may not be tolerated by hip OA*

American Geriatrics Society Panel on Exercise and Osteoarthritis. Exercise prescription for older adults with osteoarthritis pain: consensus practice recommendations. J Am Geriatr Soc 2001;49:808-823.



- Daily walking, outside or inside on a treadmill, for 20–30 minutes a day is encouraged.
- If joint pain is acute, this activity will have to be started slowly.

Aquatic exercise is invariably safe and acceptable, and the availability of community programs for people with arthritis is increasing. Warm water is more beneficial than cold.



Wang T.J, Belza B, Elaine Thompson F, Whitney JD, Bennett K. Effects of aquatic exercise on flexibility, strength and aerobic fitness in adults with osteoarthritis of the hip or knee. J Adv Nurs. 2007 Jan;57(2):141-52.

The role of occupational therapy

- Many assistive devices for reducing stress on joints are commercially available.
- Assistive devices help with feeding, grooming, dressing, and other ADL
- Training in energy conservation techniques to reduce fatigue

Occupational therapy Joint protection

- Devices to assist in the kitchen, including electric can openers, jar openers and extended tap turners, can reduce stress on the first carpometacarpal (CMC) joint by reducing the gripping force required.
- Raised toilet seats, grab rails for the bathtub or a bath bench reduce stress on lower limb joints and help patients maintain their independence
- A seat cushion or bed blocks can elevate a piece of furniture, making getting up and down possible for those with arthritis of the hip or knee.
- A running shoe with a wide, supportive heel and a good, cushioned sole may reduce jarring forces through weight-bearing joints.





Adaptive equipment

Physical therapy

- A cane may be used for extended outdoor activity but not necessarily for routine activity.
- The cane is held in the hand opposite the affected hip or knee.
- The top of the cane should be level with the proximal wrist crease when the patient is standing erect.
- For bilateral joint problems, 2 canes may be used. Crutches or a walker provide greater support and allow partial weight bearing.

Occupational therapy

- The therapist should ensure that the cane tip is in good repair for safety reasons, particularly in winter. A spike tip is available for patients walking in icy conditions.
- A simple wooden cane provides the same support as an adjustable metal cane and can be obtained from a pharmacy or medical supplier at minimal cost.



Energy conservation techniques

1. Select moderate walking speed and type of exercise (low impact activities) that does not exacerbate joint symptoms
2. Avoid maximal isometric and high velocity muscle contraction
3. Minimize use of stairs, one-legged stance, low seating and deep squatting down
4. Carry loads no more than 10% body weight
5. Use a cane on contralateral side and with reciprocal gait pattern
6. Select shoes and insoles for shock attenuation

Minor MA. Exercise in the treatment of osteoarthritis. *Rheum Dis Clin North Am* 1999;25:397-415.
 Hochberg MC, Altman RD, Brandt KD, Clark BM, Dieppe PA, Griffin MR, Moskowitz RW, Schnitzer TJ *et al.*
 Guidelines for medical management of osteoarthritis. Part I. Osteoarthritis of the hip. *Arthritis Rheum* 1995;38:1535-1540.

Orthotics

- Knee bracing is useful where lateral instability is pronounced.
- A medial wedge (for knock-knee) or a lateral wedge (for bowleg) applied to the outside of the shoe or, less frequently, to an insole in the shoe can be effective in moving the knee alignment into greater or lesser valgus or varus.
- Minor changes in alignment can produce significant changes in symptoms.
- A wedge can only be used in a sturdy shoe that is laced and fixed firmly to the foot with a good supportive heel.
- In a soft, unsupportive shoe, the wedge will not affect the movement of the foot.



Modalities

- Therapeutic cold
 - Heat
 - Ultrasound
 - TENS
 - PEMF
 - Acupuncture
- ✓ These techniques are used to prepare the patient with arthritis for exercise and should not be viewed as the treatment*
✓ The emphasis should be on exercise and education, with the goal of enabling the patient to continue an independent home program

Clark BM. *Rheumatology*: 9. Physical and occupational therapy in the management of arthritis. *CMAJ*. 2000 Oct 17;163(8):999-1005.

Thermal and electromagnetic modalities

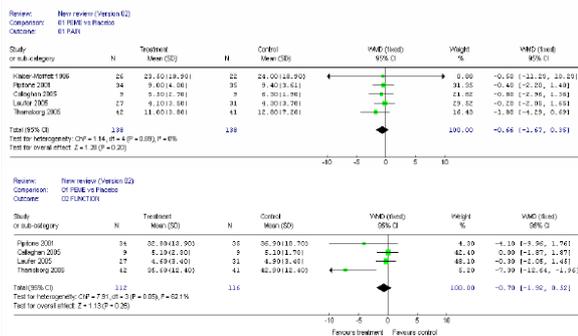
- According to a recent review of thermotherapy for the treatment of knee OA, ice massage compared to control had a statistically beneficial effect on the Range Of Motion, function and knee strength and cold packs decreased swelling(1)
- Ultrasound therapy appears to have no benefit over placebo or short wave diathermy for people with hip or knee OA.(2)

1. Brosseau L, Judd MG, Marchand S, Robinson VA, Tugwell P, Wells G, Yonge K *et al.* Thermotherapy for treatment of osteoarthritis. *The Cochrane Database of Systematic Reviews* 2003; Issue (4). Art.No. CD004522.
 2. Robinson VA, Brosseau L, Peterson J, Shea BJ, Tugwell P, Wells G. Therapeutic ultrasound for osteoarthritis of the knee. *The Cochrane Database of Systematic Reviews* 2001; Issue (3). Art. No. CD003132.

- The current evidence suggests that electrical stimulation therapy (PEMF) may provide significant improvements for knee OA.(1)
- TENS and acupuncture like TENS have been shown to be better in pain control than placebo in knee OA.(2)
- The effectiveness of low level laser therapy seems to be unreliable in the treatment of OA.(3)

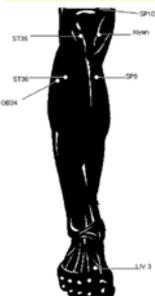
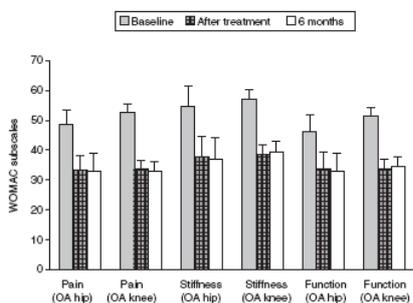
1. Hulme JM, Judd MG, Robinson VA, Tugwell P, Wells G, de Bie RA. Electromagnetic fields for the treatment of osteoarthritis. The Cochrane Database of Systematic Reviews 2002; Issue (1), Art.No. CD003523.
 2. Osiri M, Brosseau L, McGowan J, Robinson VA, Shea BJ, Tugwell P, Wells G et al. Transcutaneous electrical nerve stimulation for knee osteoarthritis. The Cochrane Database of Systematic Reviews 2000; (Issue 4), Art. No. CD002823.
 3. Brosseau L, Gam A, Harman K, Morin M, Robinson VA, Shea BJ et al. Tugwell P, Wells G, de Bie RA. Low level laser therapy (Classes I, II and III) for treating osteoarthritis. The Cochrane Database of Systematic Reviews 2004; Issue (3), Art. No. CD002046.

Plots of weighted mean difference for pain and functional disability. PEMF versus placebo PEMF



McCarthy CM, Callaghan MJ and Oldham JA Pulsed electromagnetic energy treatment offers no clinical benefit in reducing the pain of knee osteoarthritis: a systematic review *BMC Musculoskeletal Disorders* 2006, 7:51 doi:10.1186/1471-2474-7-51

Acupuncture



Linde K, Weidenhammer W, Streg A, Hoppe A, Melchart D. Acupuncture for osteoarthritic pain: an observational study in routine care. *Rheumatology (Oxford)*. 2006 Feb;45(2):222-7.

- The primary outcome was change in scores on the Western Ontario and McMaster Universities osteoarthritis index pain subscale at six months.
- Secondary outcomes included function, pain intensity, and unpleasantness of pain at two weeks, six weeks, six months, and 12 months.

WHAT THIS STUDY ADDS

Acupuncture did not provide greater reduction in pain scores when added to a course of advice and exercise delivered by physiotherapists

Benefits from acupuncture were limited to pain intensity and unpleasantness, were unlikely to be clinically significant, were mostly short lived, and could not be attributed to needling effects

Foster NE, Thomas E, Barlas P, Hill JC, Young J, Mason E, Hay EM. Acupuncture as an adjunct to exercise based physiotherapy for osteoarthritis of the knee: randomised controlled trial. *BMJ*. 2007 Sep 1;335(7617):436.

Manual modalities

- Manual therapy programs focused on specific manipulations and mobilization of the hip joint seem to be superior to exercise therapy program in patients with OA of the hip.

Hoeksma HL, Dekker J, Ronday HK, Heering A, van der Lubbe N, Vel C, Breedveld FC, van den Ende CH *et al.* Comparison of manual therapy and exercise therapy in osteoarthritis of the hip: a randomized clinical trial. *Arthritis Rheum.* 2004;51:722-9.

Key points

- **A full assessment of musculoskeletal status before designing a rehabilitation program for the individual patient.**
- **To relieve strain on affected joints;**
 - ❖ Physical therapy & modalities
 - ❖ Occupational therapy,
 - ❖ Exercises to improve strength, mobility and endurance;
 - ❖ Gait and posture training
- **Patient education to promote independent management**