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Professional practices and recommendations

Physical exercise supervised or not by a physiotherapist in the treatment of lower-limb osteoarthritis. Elaboration of French clinical practice guidelines

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Abstract

Objectives. – To develop clinical practice guidelines concerning supervised or unsupervised kinesiotherapy for treating lower-limb osteoarthritis (OA).

Method. – The SOFMER (French Physical Medicine and Rehabilitation Society) methodology, associating systematic literature review, collection of everyday clinical practice, and external review by a multidisciplinary expert panel, was used to develop guidelines.

Results–conclusion. – Physical exercise is a part of the treatment of lower-limb OA. An educational pre-program is recommended to inform the patient about the ease and effectiveness of the physical exercise. Use of the SOFMER methodology led to recommending a program of initial physical exercise supervised by a physiotherapist, then an unsupervised program at home with compliance. The type, intensity, and frequency of the exercises must be adapted to each patient. Complementary randomized controlled studies are necessary to characterize the best exercises and their intensity and frequency. The OA location and gravity, functional need, and characteristics of patients will be useful in future studies.

Keywords: Osteoarthritis; Practice guidelines; Rehabilitation; Kinesiotherapy; Physiotherapy; Physical exercise

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1. Introduction

Osteoarthritis (OA) is most frequently located in the lower limbs [1]. Multiple therapies exist for this disease, and they can be divided into three main categories: pharmacological treatments, physical treatments and, at the ultimate stage, arthroplasty. Because of the aging of the population, the incidence of OA is growing and implies a major public health problem.

During the past 15 years, physical exercises for OA has grown in interest. Many studies try to characterize the best conditions for physical exercises. Several medical scientific societies have recently published clinical guidelines for the treatment of lower limbs, particularly with nonpharmacological treatments [2–7] (Table 1). Unfortunately, these guidelines are not precise and are not adapted to primary health care.

The justification for prescribing physical activity for lower-limb OA is based on biomechanical and biological observations. The biomechanical observations are the weakness of the periarticular muscles, especially the quadriceps in knee OA leading to a failure of the shock-absorber role and accentuating the mechanical loads on cartilage, disturbance of proprioception, and progressive tightening [1]. The biological observations are the anabolic effect of cyclic mechanical stimulation on the production of extracellular matrix by cartilage and chondrocytes [8] and increased matrix glycosaminoglycan concentration by mechanical loading [9].

The benefit of physical exercise for treating lower-limb OA is now largely accepted, but the precise type, intensity, and frequency of the exercise is still vague. We aimed to develop French clinical practice guidelines concerning physical exercise supervised or not by a physiotherapist for lower-limb OA.

Table 1
Recommendations of the main professional scientific societies (reference numbers in parentheses) for treatment of OA

	Recommendations
ACR (2–4)	Education (program of education: arthritis foundation self-management program) Social support personalized by telephone contacts Loss of weight Programs of aerobic exercise Kinesiotherapy (articular amplitudes, MR, technical assistance with walking, strapping) Suitable shoes Side Corner for the OA with varus Bracing Ergotherapy (protection and articular economy, technical assistance for activities of everyday life (AVQ))
EULAR (6)	Twenty-three therapeutic methods, including the following Physical exercise with toning of the quadriceps and maintenance of articular mobility Reduction of the ponderal overload Use of canes or crutches Adapted shoes (soles) Telephone contacts with personalized counsel
Roddy (5)	Exercises of reinforcement and aerobics can reduce pain, improve function and status of health in patients with hip or knee OA Few contra-indications to the prescription of reinforcement and aerobics exercises among patients with hip or knee OA Prescription of general exercises (aerobics training, fitness) and local (reinforcement) is essential: the central aspect of the management of all hip or knee OA Kinesiotherapy for hip or knee OA must be individualized and centered on the patient, taking into account factors such as age, comorbidities and total mobility To be effective, the exercise programs must include counseling and education to promote a positive change of lifestyle with an increase in physical activities Group exercises and home-based exercises have equivalent effects, and the preference of the patient must be taken into account Compliance is the principal predictor of the long-term results of exercises among patients with hip or knee OA Strategies to improve and maintain compliance must be adopted: long-term follow-up, encouragement by the spouse and family The effectiveness of the exercise does not depend on the presence or severity of radiographic signs Improvement of the muscular force and proprioception with exercise programs may reduce the progression of hip or knee OA

2. Method

We used the SOFMER three-stage method for developing guidelines: systematic literature review, collection of information about professional practice and final scientific committee review [44].

2.1. Systematic review of the literature

2.1.1. Study selection

Literature search professionals systematically searched the PubMed, Pascal Biomed, and Cochrane Library databases for articles published from January 1966 to January 2006 using search terms defined by the scientific committee. Keywords were proposed by the steering committee composed of physical medicine and rehabilitation (PMR) and rheumatology physicians and orthopedic surgeons. The keywords were OA, hip, knee, therapy, exercise, rehabilitation, physical therapy, physiotherapy, exercise therapy, arthrose, hanche, genou, re-education, readaptation, exercise, and kinesiotherapy. Selected were abstracts of studies of all design that were published in English or French and investigated adult human patients. The literature search professionals sent abstracts to the scientific committee, who then narrowed the selection to analyze by ensuring that "rehabilitation intervention" was present in the abstract, then requested the full-length articles of the selection from the professional literature searchers. Two experts from two different medical specialties (rheumatologist [Y.D.] and PMR physician [B.B.]) retained articles related to rehabilitation of lower-limb OA. Finally, the abstracts of articles cited as references were analyzed. The quality of each manuscript was assessed according to the four-level grading scale of the French Agency for Accreditation and Evaluation in Healthcare (ANAES) [44].

2.1.2. Outcomes

Two main outcomes were assessed:

- Type of program. We defined exercises that were "directed exercise therapy" if they were carried out and taught by a physiotherapist, in either an individual program or a group session, during at least eight sessions or at least more than 4 h. We considered "nondirected exercise therapy" any program of exercise carried out for individuals or groups, taught or not by a professional who was not qualified in physical therapy (physical therapist), rheumatology or PMR.
- Functional criteria based on validated questionnaires, physical performance, or deficiencies in, for example, muscular strength or speed of walking.

2.1.3. Data analysis

Two blinded independent reviewers, a rheumatologist (Y.D.) and a PMR physician (B.B.), analyzed the data.

2.2. Daily practice

Daily practice related to rehabilitation of lower-limb OA was recorded at the national congresses of rehabilitation (SOFMER Congress, Rouen, France, October 18, 2006) and rheumatology [Société Française de Rhumatologie (SFR) National Congress, Paris, December 4–5, 2006], by use of an electronic voting device. After the vote, the literature data were presented by one of the two experts (Y.D.). Then, the session was open for questions and comments. A medical secretary took notes during the question-and-comment period [44].

2.3. Elaboration of recommendations and external review by a reading committee

Practice guidelines based on literature review and daily practice were written, then reviewed by the scientific committee before their validation by a reading committee [44].

3. Results

3.1. Literature review

3.1.1. Article selection

The scientific committee selected 172 manuscripts from PubMed, 74 from Pascal Biomed and six from the Cochrane database. The reviewers (Y.D. and B.B.) retained 47 of these articles.

3.1.2. Methodological quality of studies

The two experts did not differ in grading studies by use of the ANAES scale (Tables 2–4). Among the 47 articles selected, 15 were review articles and 32 reports of randomized clinical trials (RCTs). Four RCTs compared two methods of physical exercises: one program directed by a physiotherapist, associated or not with a program at home, versus a nondirected program [10–13]; all four were graded level 1 by the ANAES scale. Ten RCTs evaluated the effectiveness of a program of nondirected exercise [14–23]; seven were level 1 and, 3 level 2. Eighteen RCTs evaluated a program of exercise directed by a physiotherapist, for individuals or groups [24–42]; eight were level 1 and 10 level 2. Finally, one article described an evaluation of the repercussions of physical activity on the cartilage at a more fundamental level [9].

3.1.3. Results of data extraction

The articles described heterogeneous programs, which disallowed easy comparison of the results. Most studies compared the effectiveness of a program of exercise, directed or not, with or without an educational program. Results are in favor of programs of exercises for pain, physical function, incapacity, and satisfaction, with a tendency to decreased benefit with lack of compliance. Few articles described directed versus nondirected programs of exercise.

3.1.3.1. Programs of nondirected exercises. Among the selected articles, three RCTs with an ANAES level of proof of 1, described the effectiveness of nondirected exercises for treating lower-limb OA.

Petrella and Bartha [14] compared a progressive combination of exercises at home with a control program among 179 patents

Table 2
Programs of nondirected exercises

Author	Population	Trial ANAES	Sample size	Intervention	Outcome measurements	Results			Remark
Petrella and Bartha [14] 2000	Older subjects with unilateral knee OA	RCT Level 1	184	I: mobility training + strengthening (28 sessions) C: exercises without weight, stretching, no resistance	Pain (P) WOMAC VAS rest VAS after walking (spw) [45] VAS after climbing (sps) [46] Physical Function (PF) Walking time Stair climbing time Mobility WOMAC PF WOMAC Stiffness (S) Level of physical activity PASE [46]	S S S S S S S S NS NS			Short evaluation, about 8 weeks Consideration such as placebo and exercise program
Messier et al. [15] 2004	Knee OA Obesity	RCT Level 1	316	I1: diet only I2: exercises only I3: diet + exercises C: usual life	WOMAC PF Weight loss mobility WOMAC P 6 min walk test stair-climbing test	I1/C NS S NS NS NS NS	I2/C NS NS NS NS S NS NS	I3/C S S NS S S S S	Results evaluated with an inappropriate tool
Ettinger et al. [16] 1997	Knee OA	RCT Level 1	365	I1: walking program I2: strengthening C: education	SRPD [47] Pain Physical performance [48,49] Aerobic capacity Strengthening	I/C S S S S(I1) S(I2)		I1/I2 NS NS NS S(I1) S(I2)	Poor amelioration/another trial (here control is not absence of activity). No information about the activity in group C Low intensity program Evaluation at 18 months with poor compliance. Medication was not specified
Cochrane et al. [17] 2005	Knee and or hip OA	RCT Level 1	312	I: Water therapy. Warm-up-mobility training-strengthening-proprioception-aerobic C	WOMAC P PF S SF 36 P Physical Activity Mental Health Vitality General health EuroQol Mobility Walking/climbing Strength Q/H	S at 1 year S at 1 year NS S at 6 months and 1 year S at 6 months S at 6 months S at 6 months S at 6 months NS NS NS NS All NS at 18 months			Results diluted in intervention group by the 15 % who made any session
Penninx et al. [18] 2001	Older subjects with knee OA	RCT Level 1	250	I1: walking program I2: strengthening C: education	Daily Life Activity Index [48,50]	I/C S			
Messier et al. [19] 2000	Knee/hip OA	RCT Level 1	103	I1: walking program I2: strengthening C: education	Balance Bipodal eyes opened Bipodal eyes closed Monopodal e. opened Monopodal e. closed	I1/C NS NS S NS	I2/C NS NS NS NS		

(continued)

Table 2 *(continued)*

Author	Population	Trial ANAES	Sample size	Intervention	Outcome measurements	Results		Remark
Ravaud et al. [20] 2004	Knee/hip OA	RCT Level 1	2957	I1: Pain evaluation and DLA difficulty in the (rhumato) I2: Home exercises (rhumato) I3: evaluation + exercises (rhumato) C: usual therapy (rhumato)	VAS (past week) WOMAC PF General Health self-evaluation Treatment satisfaction	/beginning S S S	I/C NS NS NS S(I2-3)	C is not lack of treatment. High level of no compliance
Thomas et al. [21] 2002	Knee pain	RCT Level 2	786	I1: Srengthening-mobility-locomotor function I2: monthly contact I3: exercises + contact C: usual life	WOMAC P PF and S SF36 (Mental evaluation) Isometric strength	I1-3/C S S NS S	I2/C NS NS NS NS	Knee pain without precision
O'Reiley et al. [22] 1999	Knee pain	RCT Level 2	191	I: isometric and isotonic strengthening + education C: education	WOMAC P PF VAS P climbing and walking	S S S		No compliance Knee pain without precision Insufficient power
Baker et al. [23] 2001	Knee OA	RCT Level 2	46	I: Functional exercises + isotonic strengthening C: nutrition advice	WOMAC P FP Physical Exam Strength of Q Physical performances SF36	S S S S S S		Low power No blind evaluation

S: significant; NS: non significant; Spw: self-paced walking; sps: self paced stepping; PASE: Physical Activity Scale in the Elderly; SRPD: self-reported physical disability; I: intervention; C: control; VAS: visual analog scale; WOMAC: Western Ontario and MacMaster Universities OA Index; RCT: randomized controlled trial.
Q: quadriceps; H: hamstring; DLA: daily living activity.

with knee OA (Altman stages I–III). The program of exercise was progressive in intensity and frequency and included joint mobilizations, stretching and reinforcement of the lower limbs in opened and closed chains. Scores for the exercise group were significantly better than for the control group on the Western Ontario and MacMaster Universities Osteoarthritis Index (WOMAC) sub-scales for pain and physical function, as well as pain after functional tasks and articular mobility. Compliance was significantly better in the exercise group.

Messier et al. [15] compared, over 18 months, the effects of physical exercise and diet only or their combination in elderly people with knee OA. WOMAC scores were significantly better for both groups at 18 months but better for the exercise-and-diet group as compared with controls. Both diet-alone and exercise-and-diet groups showed a significant reduction in weight at 18 months, and physical test results were significantly improved in the exercise-and-diet than control group.

Ettinger et al. [16] compared the effects of a program involving walking [(aerobic group (AG)], muscular reinforcement (MR) and education (the control group)). At 3, 9 and 18 months, the AG and MR groups showed significant improvement in self-evaluation of incapacity. Pain after six physical activities was significantly decreased in both groups as compared with the control group. The 6-min walk score was better for the AG and MR groups than the control group. Likewise, the test of going up and down stairs was better for the AG.

3.1.3.2. Programs of directed exercises. Of the three RCTs level-1 studies of directed exercise, Hoeksema et al. [25] compared the effectiveness of a program of manual therapy with a program of exercises directed by a physiotherapist in hip OA patients. After 5 weeks, total improvement, on a six-point scale, was significantly better in the two groups. Results for the manual therapy group were significantly better than the physiotherapist-directed exercise group for pain, stiffness, function of the hip by the Harris score, as well as articular amplitudes and speed of walking.

Foley et al. [24] compared the effectiveness of water-based versus gymnastic programs of therapyin OA patients. Both exercise groups showed improved force and physical capacities as compared with the control group, with no significant difference in improvement between both groups.

Van Baar et al. [27,28] evaluated the effectiveness of treatment with physical exercises in knee or hip OA patients. After 18 weeks, physical exercise resulted in a significant improvement in pain, disability, and total perception of condition by the patient as compared with the control group, as well as reduced use of paracetamol.

3.1.3.3. Programs of exercises directed or not by a physiotherapist. Two level-1 articles described a comparison of directed and undirected programs of physical exercise. McCarthy et al. [10] compared the effects of a home-based program of exercises with an 8-week program directed by a physiotherapist and associated with a home-based exercise program. The directed exercise group showed improved assessment of locomotor function (ALF) score, at 2, 6 and 12 months as compared with the nondirected exercise group. As well, as compared with the nondirected exercise group, the directed exercise group showed improved scores on the WOMAC subscale for pain at 2, 6 and

Table 3
Programs of directed exercises

Author	Population	Trial ANAES	Sample size	Intervention	Outcome measurements	Results		Remark
Foley et al. [24] 2003	OA	RCT Level 1	105	I1: warmup+dynamic strengthening in balneotherapy I2: warmup+dynamic strengthening C: phone contact	Q strengthening 6-min walking test WOMAC SF12 AAP [51] ASES [52]	I1/C S S NS S NS NS	I2/C S S NS NS NS S	Not very intensive program Only strengthening
Hoeksema et al. [25] 2004	Hip OA	Randomized Comparative Trial Level 1	109	I1: manual therapy I2: strengthening, mobility, walking,	General amelioration SF36 Harris Hip Score Walking test Mobility Pain S	I/beginning S S S S S S	I1/I2 NS S(PF) S S S S	No precise compliance results
Bennell et al. [26] 2005	Knee OA	RCT Level 1	140	I: Q strengthening, hip and spinal muscles, balance, dorsal mobility, massage C: placebo falls US	Pain during movement (VAS) WOMAC SF36 Q strengthening Balance test	NS NS NS NS NS		No real control group. Strong placebo effect. Program not sufficiently adapted Strapping?
Van Baar et al. [28] 2001	Hip and knee OA	RCT Level 1	201	I: strengthening-stretching-mobility-coordination-ability in DLA and elementary movements C: education	Pain NSAID consumption Functional discomfort [53]	S à 24 semaines NS NS		
Fransen et al. [29] 2001	Knee OA	RCT Niveau 1	126	I1: individual physical therapy I2: stretching-aerobic-strengthening C: 8 weeks and randomization to I1 or I2	WOMAC SF 36 Physical Function isometric strength walking speed larger of step	I/C S S S	I1/I2 NS NS NS	Not too powerful
Huang et al. [30] 2005	Knee OA	RCT Level 1	140	I1: isokinetic strengthening (IS) I2: IS + US I3: IS + US + visco supplementation C: warmup	Lequesne Index Peak tork of Q/H Walking speed Pain (VAS)	I/begin S S S S	I/C S I1-2-3 S I3 S I1-2-3 S I2	
Quilty et al. [31] 2003	Femoro patellar OA	RCT Level 1	87	I: Patella taping-vaste medialis strengthening-balance-postures-advice + diet C: no intervention	W PF Pain (VAS) Q strength	NS S at 5 months NS at 12 S at 5 months NS at 12		
Hopman-Rock and Westhoff [32] 2000	Hip and knee OA	RCT Level 1	119	I: education + warmup-static and dynamic strengthening+home exercises program C: no intervention	Pain (IRGL) Qol Mobility Q strengthening Activity (4 tasks) Lorig scale [52]	S S NS S NS S		No compliance for the home exercises program
Deyle et al. [33] 2000	Knee OA	RCT Level 2	83	I: stretching-strengthening-cyclo + manual therapy C: subtherapeutic intensity US	6-min walk test WOMAC	S S		

(continued)

Table 3 *(continued)*

Author	Population	Trial ANAES	Sample size	Intervention	Outcome measurements	Results		Remark
Tak et al. [34] 2005	Hip OA	RCT Level 2	109	I: warmup-strengthening + home program C: contact with general practicer to the patient initiative	Pain during the past month (VAS)	S		Low power
					Harris Hip Score	S		No indication about exercise frequency
					Pain	NS		
					Function	NS		
					Capacity	NS		
					Mobility	S		
					Activities (4 tasks)	NS		
					GARS [54]	NS		
					Qol			
					HRQol			
Thorstensson et al. [35] 2005	Middle age subjects (35–55) knee OA	RCT Level 2	61	I: stand up exercises-postural control-endurance-strengthening C: Usual style of living	KOOS [55,56]	NS		Low power
					SF-36	S at 6 w NS at 6 m		
					cyclo ergometric test	NS		
					Physical performances tests	NS		
Diracoglu et al. [36] 2005	Knee OA	RCT Level 2	66	I1: Proprioception-balance-isotonic strengthening I2: strengthening	WOMAC	I/begin.	I1/I2	Low power
					PF	S	S (I1)	No control
					P	S	NS	
					S	S	NS	
					SF 36	S	NS	
					10 stairs climbing	S	NS	
					Q strengthening	S	NS	
					Proprioception	S	NS	
Rogind et al. [37] 1998	"Severe" knee OA	RCT Level 2	25	I: mobility-stretching-venous drainage -strenthening-proprioception-balance C: no information	Q/H strength	S		Low power
					Lequesne Index	S		Poor information about the control group
					Pain (VAS)	S		
					Walking speed	S		
					Physical exam	S		No compliance after intervention
Corrêa Dias et al. [38] 2003	Knee OA	RCT Level 2	50	I: stretching-strengthening-aerobic C: education and DLA	HAQ	S		Low power
					Lequesne Index	S		No Intention To Treat
					SF-36	S		
					PF	S		No information about compliance or activity after education in control group
					P	NS		
					Mental			
Kovar et al. [39] 1992	Knee OA	RCT Level 2	92	I: education- sportive walk-stretching-strengthening + home program C: DLA	6-min walking test	S		Low power
					AIMS [57,58]	S		Evaluation was not blinded
					Physical activity	NS		
					Impact	S		
					Pain	NS		
					Medication			
Börjessen et al. [40] 1996	Internal knee OA before surgery	Level 2	68	Strengthening Mobility	Patient opinion	S		Low power
					Stairs climbing	S		No compliance
					Pain	NS		Surgery programmed
					Mobility	NS		Blind evaluation doubtful
					Strength	NS		
					Gait	NS		
Cheing and Hui-Chan [41] 2002	Knee OA	RCT Level 2	62	I1: TENS I2: Strengthening I3: TENS + strengthening C: Placebo Stimulation	VAS pain	First session/begin. S I1-3-C First session/C S I1-3		Blind evaluation doubtful Low power No compliance information
Cheing and Hui-Chan [42] 2004	Knee OA	RCT Level 2	66	I1: TENS I2: Strengthening I3: TENS + strengthening C: Placebo Stimulation	Q isometric peak tork	I/begin.	/C	Blind evaluation doubtful Low power No compliance information
					Mobility	S(I3)	NS	
					Proprioception	S(I3)	NS	
						S(I3)	NS	

AAP: adelaïde activities profile; ASES: arthritis self-efficacy scale; KOOS: knee injury and osteoarthritis outcome score; AIMS: arthritis impact measurement scale; IRGL: impact of rheumatic diseases on general health and lifestyle; GARS: groningen activity restriction scale; TENS: transcutaneous electrical nerve stimulation.

Table 4
Programs of directed versus nondirected exercises

Author	Population	Trial ANAES	Sample size	Intervention	Outcome measurements	Results	Remark
McCarthy et al. [10] 2004	Knee OA	Randomized Comparative Trial Level 1	214	I1: home program I2: group program with physical therapist + home program (strengthening-endurance-mobility-balance)	ALF score [59] VAS pain Womac P PF S SF-36 P PF Other EuroQol Isometric Q strength Balance Knee flexion	I2 > I1 S at 12 months S at 12 months S at 12 months S at 12 months S post treatment S at 6 months S at 12 months NS NS S post treatment S post treatment S post treatment	No group control
Deyle et al. [12] 2005	Knee OA	Randomized Comparative Trial Level 1	134	I1: manual therapy + program of directed exercises + home program (mobility-strengthening-stretching-endurance) I2: home program	6-min walking test WOMAC	/begin. I1/I2 S(I1-2) NS S(I1-2) S (I1)	No group control
Maurer et al. [11] 1999	Knee OA	Randomized Comparative Trial Level 1	113	I1: unilateral isokinetic strengthening I2: education program, booklet, video	Isometric and isokinetic strength WOMAC SF 36	/début I1/I2 S(I1-2) NS S(I1-2) NS S(I1-2) NS	No group control Physical therapy: only unilateral strengthening
Hughes [13] 2004	Older subjects with OA	RCT Level 1	150	I1: Physical therapy in group + home program (strengthening-endurance-education I2: booklet + exercises list	LSES [52] 6-min walking test Q strength Pain	S S S S	Blind evaluation doubtful No real control group

ALF: assessment of locomotor function; LSES: Lorrig Self-Efficacy Scales.

12 months and on the stiffness and physical function subscales at 2 months. The directed exercise group had a significantly better Medical Outcomes Study Short Form 36 (SF-36) score at 2 and 6 months than the nondirected exercise group but not at 12 months, except for the pain sub-scale score. The results tended to decrease with time.

Deyle et al. [12] compared in a multicentric study the effectiveness of treatment with some supervised exercises and techniques of manual therapy with a home-based program of exercise in knee OA. The two groups showed significant improvement in WOMAC score (pain and physical function) at 4 weeks. At 1 year, both groups still showed significant improvement from baseline scores. At 4 weeks, the 6-min walk was significantly improved in the 2 groups but not at 1 year. Satisfaction at 1 year was significantly better in the supervised exercise group and analgesic use less.

Some well-done studies did not show the superiority of an exercise program supervised [26] or not [20] over a control program of education or usual treatment. However, these studies showed significant effectiveness of exercise on pain and incapacity compared with baseline data and no serious deleterious effects.

3.2. Daily practice of physicians

Hip and knee OA (Tables 5 and 6).

Table 5
Comparison between rheumatologists and PMR physicians in terms of exercise programs proposed for hip OA treatment

Do you use an auto-program to treat hip osteoarthritis?	PMR physicians (%)	Rheumatologists (%)
Yes, teach by myself during consultation	11	24
Yes, teach by the physical therapist with prescription	20	19
Yes, teach by myself and the physical therapist	33	39
Yes, I give a standard document	7	6
No	29	11

Table 6
Comparison between rheumatologists and PMR physicians in terms of exercise programs proposed for knee OA treatment

Do you use an auto-program to treat knee osteoarthritis?	PMR physicians (%)	Rheumatologists (%)
Yes, teach by myself during consultation	9	15
Yes, teach by the physical therapist with prescription	12	15
Yes, teach by myself and the physical therapist	46	51
Yes, I give a standard document	6	5
No	27	14

Professional practices differ between PMR physicians and rheumatologists. For hip OA, 64% of the PMR physicians used a self-program of exercise they or the physiotherapist

taught as compared with 82% of the rheumatologists. For knee OA, the differences were similar: 67% versus 81%. PMR physicians less often prescribed self-directed programs of exercise.

4. Discussion

An analysis of articles describing directed versus nondirected exercise programs for the treatment of OA confirms the utility of exercise programs for patients with hip and especially knee OA. The studies were mainly devoted to knee OA. The two most informative studies comparing the effectiveness of exercises directed or not by a physiotherapist show a weak but significant advantage in terms of pain and short-term incapacity.

Other study results favor physiotherapy, since with some techniques, such as water therapy [24] or manual therapy [25,33], physiotherapy associated with a program of directed exercise seems to be able to help with pain and incapacity in OA [41,43].

Our study has several limitations. The first difficulty was in defining the meaning of directed and nondirected physiotherapy. We considered that a minimum of eight meetings or 4 h of physiotherapy was necessary to qualify the exercise as directed. This definition perhaps lacks rigor and does not take into account the quality of therapy or the capacity of patients to integrate, more or less quickly, the required exercises. All treatment not carried out by a physiotherapist within these quantitative limits was considered as nondirected physiotherapy. Another limitation is the few studies with good methodology available for analysis. As well, among the analyzed studies, we observed a diversity of programs suggested, diversity of tools for evaluation, and lack of long-term analysis. We did not have available integrated studies of exercise programs we would have considered as nondirected, such as the often encouraging studies analyzing the effects of cultural work programs such as Taï Chi Chuan, a soft technique of exercise, which is complete and "philosophic".

5. Recommendations

Physical exercise is a part of the treatment of lower-limb OA. An educational pre-program is recommended to inform the patient about the ease and effectiveness of the exercise. Our combination of literature review and analysis of the daily practice of French physicians led to a recommendation for beginning a physical exercise program supervised by a physiotherapist and then continuing with a self-administered program at home with good compliance. The content, intensity, and frequency of the exercises must be adapted to each patient. Complementary RCTs are necessary to characterize the best exercises and their intensity and frequency. The localization, gravity of OA, functional need, and characteristics of patients will be useful in these future studies.

References

[1] Fransen M, McConnell S, Bell M. Exercise for osteoarthritis of the hip or knee (Cochrane Review). In: The Cochrane Library, Issue 3. Oxford: Update Software; 2003.

[2] American College of Rheumatology, Hochberg MC, Altman DR, Brandt KD, Clark BM, Dieppe PA, Griffin MR. Guidelines for the management of osteoarthritis. Part I. Osteoarthritis of the hip. Arthritis Rheum 1995;38:1535–40.

[3] American College of Rheumatology, Hochberg MC, Altman DR, Brandt KD, Clark BM, Dieppe PA, Griffin MR. Guidelines for the management of osteoarthritis. Part II. Osteoarthritis of the knee. Arthritis Rheum 1995;38:1541–6.

[4] American College of Rheumatology Subcommittee on Osteoarthritis Guidelines. Recommendations for the management of osteoarthritis of the hip and knee 2000 update. Arthritis Rheum 2000;43:1905–15.

[5] Roddy E, Zhang W, Doherty M, Arden NK, Barlow J, Birrell F, et al. Evidence-based recommendations for the role of exercise in the management of osteoarthritis of the hip or knee–the MOVE consensus. Rheumatol 2005;44:67–73.

[6] Mazières B, Bannwarth B, Dougados M, Lequesne M. Recommandations de l'EULAR pour traiter la gonarthrose. Résultats d'un groupe de travail du comité directeur des études cliniques internationales incluant les essais thérapeutiques de l'EULAR. Rev Rhum 2001;68:408–19 [Ed Fr].

[7] Ottawa Panel evidence-based clinical practice guidelines for therapeutic exercises and manual therapy in the management of osteoarthritis. Phys Ther 2005;85:907–71.

[8] Rannou F, Poiraudeau S, Revel M. Le cartilage : de la mécanobiologie au traitement physique. Ann Réadaptation Méd Phys 2001;44:259–67.

[9] Roos EM, Dahlberg L. Positive effects of moderate exercise on glycosaminoglycan content in knee cartilage. A four-month, randomized, controlled trial in patients at risk of osteoarthritis. Arthritis Rheum 2005;52:3507–14.

[10] McCarthy CJ, Mills PM, Pullen R, Richardson G, Hawkins N, Roberts CR, et al. Supplementing a home-based exercise program with a class-based program for people with osteoarthritis of the knee: a randomized controlled trial and health economic analysis. Health Technol Assess (Rockv) 2004;8(46):1–61.

[11] Maurer T, Stern AG, Kinossian B, Cook KD, Schumacher HR. Osteoarthritis of the knee: isokinetic quadriceps exercise versus educational intervention. Arch Phys Med Rehabil 1999;80:1293–9.

[12] Deyle GD, Allison SC, Matekel RL, Ryder MG, Stang JM, Gohdes DD. Physical therapy treatment effectiveness for osteoarthritis of the knee: a randomized comparison of supervised clinical exercise and manual therapy procedures versus home exercise program. Phys Ther 2005;85:1301–17.

[13] Hughes SL. Impact of the fit and strong intervention on older adults with osteoarthritis. Gerontologist 2004;44:217–28.

[14] Petrella RJ, Bartha C. Home based exercise therapy for older patients with knee osteoarthritis: a randomized clinical trial. J Rheumatol 2000;27:2215–21.

[15] Messier SP, Loeser R, Miller GD, Morgan TM, Rejeski WJ, Sevick MA, et al. Exercise and dietary weight loss in overweight and obese older adults with knee osteoarthritis. The Arthritis, Diet and Activity Promotion Trial. Arthritis Rheum 2004;50:1501–10.

[16] Ettinger WH, Burns R, Messier SP, Applegate W, Rejeski WJ, Morgan T, et al. A randomized trial comparing aerobic exercise and resistance exercise with a health education progrm in older adults with knee osteoarthritis. The Fitness Arthritis and Seniors Trial (FAST). JAMA 1997;277:25–31.

[17] Cochrane T, Davey RC, Matthes Edwards SM. Randomised controlled trial of the cost-effectiveness of water-based therapy for lower limb osteoarthritis. Health Technol Assess (Rockv) 2005;9(31).

[18] Penninx BW, Messier SP, Rejeski WJ, Williamson JD, DiBari M, Cavazzini C, et al. Physical exercise and the prevention of disability in activities of daily living in older persons with osteoarthritis. Arch Intern Med 2001;161:2309–16.

[19] Messier SP, Royer TD, Craven TE, O'Toole ML, Burns R, Ettinger WH. Long-term exercise and its effect on balance in older, osteoarthritic adults: results from the Fitness, Arthritis, and Seniors Trial (FAST). JAGS 2000;48:131–8.

[20] Ravaud P, Giraudeau B, Logeart I, Larguier JS, Rollan D, Trevers R, et al. Management of osteoarthritis (OA) with an unsupervised home

based exercise program and/or patient administered assessment tools. A cluster randomised controlled trial with a 2 × 2 factorial design. Ann Rheum Dis 2004;63:703.
[21] Thomas KS, Muir KR, Doherty M, Jones AC, O'Reilly SC, Bassey EJ. Home based exercise program for knee pain and knee osteoarthritis: randomised controlled trial. BMJ 2002;325:752–6.
[22] O'Reiley SC, Muir KR, Doherty M. Effectiveness of home exercise on pain and disability from osteoarthritis of the knee: a randomised controlled trial. Ann Rheum Dis 1999;58:15–9.
[23] Baker RK, Nelson ME, Felson DT, Layne JE, Sarno R, Roubenoff R. The efficacy of home based progressive strength training in older adults with knee osteoarthritis: a randomized controlled trial. J Rheumatol 2001; 28:1655–65.
[24] Foley A, Halbert J, Hewitt T, Crotty M. Does hydrotherapy improve strength and physical function in patients with osteoarthritis—a randomised controlled trial comparing a gym based and a hydrotherapy based strengthening program. Ann Rheum Dis 2003;62:1162–7.
[25] Hoeksema HL, Dekker J, Ronday HK, Heering A, Van Der Lubbe N, Vel C. Comparison of manual therapy and exercise therapy in osteoarthritis of the hip: a randomized clinical trial. Arthritis Rheum 2004;51: 722–9.
[26] Bennell KL, Hinman RS, Metcalf BR, Buchbinder R, McConnell J, McColl G. Efficacy of physiotherapy management of knee joint osteoarthritis: a randomised, double blind, placebo controlled trial. Ann Rheum Dis 2005;64:906–12.
[27] Van Baar ME, Dekker J, Oostendorp RA, Bijl D, Voorn TB, Lemmens JA, Bijlsma JW. The effectiveness of exercise therapy in patients with osteoarthritis of the hip or knee: a randomized clinical trial. J Rheumatol 1998;25(12):2432–9.
[28] Van Baar ME, Dekker J, Oostendorp RA, Bijl D, Voorn TB, Bijlsma JW. Effectiveness of exercise in patients with osteoarthritis of hip or knee: nine months' follow up. Ann Rheum Dis 2001;60:1123–30.
[29] Fransen M, Crosbie J, Edmonds J. Physical therapy is effective for patients with osteoarthritis of the knee: a randomized controlled clinical trial. J Rheumatol 2001;28:156–64.
[30] Huang MH, Yang RC, Lee CL, Chien TW, Wang MC. Preliminary results of integrated therapy for patients with knee osteoarthritis. Arthritis Rheum 2005;53:812–20.
[31] Quilty B, Tucker M, Campbell R, Dieppe P. Physiotherapy, including quadriceps exercises and patellar taping, for knee osteoarthritis with predominant patello-femoral joint involvement: randomized controlled trial. J Rheumatol 2003;30:1311–7.
[32] Hopman-Rock M, Westhoff MH. The effects of a health educational and exercise program for older adults with osteoarthritis of the hip or knee. J Rheumatol 2000;27:1947–54.
[33] Deyle GD, Henderson NE, Matekel RL, Ryder MG, Garber MB, Allison SC. Effectiveness of manual physical therapy and exercise in osteoarthritis of the knee. A randomized controlled trial. Ann Intern Med 2000;132:173–81.
[34] Tak E, Staats P, Van Hespen A, Hopman-Rock M. The effects of an exercise program for older adults with osteoarthritis of the hip. J Rheumatol 2005;32:1106–13.
[35] Thorstensson CA, Roos EM, Petersson IF, Ekdhal C. Six-week high-intensity exercise program for middle-aged patients with knee osteoarthritis: a randomized controlled trial. BMC Musculoskelet Disord 2005; 6:27–36.
[36] Duracoglu D, Aydin R, Baskent A, Celik A. Effects of kinesthesia and balance exercises in knee osteoarthritis. J Clin Rheumatol 2005;11:303–10.
[37] Rogind H, Bibow-Nielsen B, Jensen B, Moller HC, Frinodt-Moller H, Bliddal H. The effects of a physical training program on patients with osteoarthritis of the knees. Arch Phys Med Rehab 1998;79:1421–6.
[38] Corrêa Dias R, Domingues Dias JM, Ramos LR. Impact of an exercise and walking protocol on quality of life for elderly people with OA of the knee. Physiotherapy Res Inter 2003;8:121–30.
[39] Kovar PA, Allegrante JP, Mac Kenzie R, Peterson MGE, Gutin B, Charlson ME. Supervised fitness walking in patients with osteoarthritis of the knee. A randomized, controlled trial. Ann Intern Med 1992;116:529–34.
[40] Börjesson M, Robertson E, Weidenhielm L, Mattsson E, Olsson E. Physiotherapy in knee osteoarthrosis: effect on pain and walking. Physiother Res Int 1996;1:89–97.
[41] Cheing GLY, Hui-Chan CWY. Does four week of TENS and/or isometric exercise produce cumulative reduction of osteoarthritic knee pain? Clin Rehabil 2002;16:749–60.
[42] Cheing GLY, Hui-Chan CWY. Would the addition of TENS to exercise training produce better physical performance outcomes in people with knee osteoarthrits than either intervention alone? Clin Rehabil 2004;18: 487–97.
[43] Huang MH, Lin YS, Lee CL, Yang RC. Use of ultrasound to increase effectiveness of isokinetic exercise for knee osteoarthritis. Arch Phys Med Rehabil 2005;86:1545–51.
[44] Rannou F, Coudeyre E, Ribinik P, Macé Y, Poiraudeau S, Revel M. Establishing recommendations for rehabilitation interventions: the SOFMER methodology. Ann Readapt Med Phys 2007;50:106–10.
[45] Petrella RJ, Koval JJ, Cunningham DA, Paterson DH. Predicting VO_2 max in community dwelling seniors using a self-paced step test. Med Sci Sports Ecerc 1998;30:S76 [abstract].
[46] Washburn RA, Smith KW, Jette AM, Janney CA. The physical activity scale for the elderly (PASE): development and evaluation. J Clin Epidemiol 1993;46:153–62.
[47] Ettinger WH, Fried LP, Harris T, Shemanski L, Schulz R, Robbins J. Self reported causes of physical disability in older people: the cardiovascular health study. J Am Geriatr Soc 1994;42:1035–44.
[48] Rejeski WJ, Ettinger WH, Shumaker S, James P, Burns R, Elam JT. Assessing performance related disability in patients with knee osteoarthritis. Osteoarthritis Cartilage 1995;3:157–67.
[49] Rejeski WJ, Ettinger WH, Shumaker S, et al. The evaluation of pain in patients with knee osteoarthritis: knee pain scale. J Rheumatol 1995;22: 1124–9.
[50] Katz S, Ford AB, Moskowitz RW, Jackson BA, Jaffe MW. Studies of illness in the aged: the index of ADL: a standardized measure of biological and psychological function. JAMA 1963;185:94–9.
[51] Clark MS, Bond MJ. The Adelaïde activities profile: a measure of the lifestyle activities of elderly people. Aging Clin Exp Res 1995;7:174–84.
[52] Lorig K, Chastain RL, Ung E, Shoor S, Holman HR. Development and evaluation of a scale to measure perceived self-efficacy in people with arthritis. Arthritis Rheum 1989;32:37–44.
[53] Keefe FJ, Caldwell DS, Queen K, Gil KM, Martinez S, Crisson JE, et al. Osteoarthritic knee pain: a behavioral analysis. Pain 1987;28:309–21.
[54] Kempen GIJM, Doeglas DM, Stuurmeijer TPBM. Groningen Activity Restriction Scale (GARS): a manuel Groningen. University of Groningen; 1993.
[55] Roos EM, Roos HP, Lohmander LS, Ekdahl C, Beynnson BD. Knee injury and Osteoarthritis Outcome Score (KOOS)—development of a self-administered outcome measure. J Orthop Sports Phys Ther 1998; 28:88–96.
[56] Roos EM, Roos HP, Ekdahl C, Lohmander LS. Knee injury and Osteoarthritis Outcome Score (KOOS)—validation of a Swedish version. Scand J Med Sci Sports 1998;8:439–48.
[57] Meenan RF. The AIMS approach to health status measurement: conceptual background and measurement properties. J Rheumatol 1982;9:785–8.
[58] Mason JH, Anderson JJ, Meenan RF. Applicability of a health status model to osteoarthritis. Arthritis Care Res 1989;2:89–93.
[59] Hurley MV, Scott DL. Improvements in quadriceps sensorimotor function and disability of patients with knee osteoarthritis following a clinically practicable exercise regime. British Journal of Rheumatology 1998; 37:1181–7.