



Published by DiscoverSys

The principle of non-pharmacologic management of osteoarthritis



CrossMark

Cok Gede Dalem Kurniawan^{1,2*}

ABSTRACT

Background: Osteoarthritis (OA) is a common problem in the elderly population and has very significant effect toward the daily activity of the elderly. The incidence and prevalent of OA is expected to increase in the upcoming decade with the doubling of the aging population. The management of OA could be classified into surgical and non-surgical with the latter could be further divided into pharmacological and non-pharmacological. Despite a wide array of publications discussing about surgical and pharmacological

intervention of OA, there are still little references about its non-pharmacological intervention.

Aim: Thus, the aim of this review is to describe about the non-pharmacological rehabilitative management of OA which is considered as more applicable with less side effect compared to surgical or pharmacological intervention.

Conclusion: Hopefully, the information would be helpful in constructing a more comprehensive approach toward OA patient especially in elderly.

Keywords: Osteoarthritis, non-pharmacological, rehabilitative management

Cite This Article: Kurniawan, C.G.D. 2018. The principle of non-pharmacologic management of osteoarthritis . *IJBS* 12(1): 19-23. DOI:10.15562/ijbs.v12i1.152

INTRODUCTION

Osteoarthritis (OA) is the most common joint disease in the elderly population caused by ageing and continuous stress in the joint cartilage. The most prominent hallmarks of osteoarthritis are progressive damage and loss of articular cartilage, subchondral trabeculae bone thickening, and osteophytes formation at the joint margin and sometimes accompanied by low-grade synovitis. OA commonly affect weight bearing joints such as joints of the lower extremities and lumbar joints. However, it is a ubiquitous disease in principle so could affect any other joints albeit with much lower rate.^{1,2}

The risk of OA generally increased exponentially between 30 to 65 years of age, reaching almost 10 times higher in 65 years old people. It was estimated that OA affect approximately 33.6% of people aged 65 years or older with knee OA as the predominant disease.^{3,4} With increasing number of aged population, the incident and prevalence of OA is expected to increase continuously in the future. Increased prevalence of obesity is also contributed largely to the increased risk of OA mainly because of sedentary lifestyle, change in physical activity, diet and working environment. The urgency of OA resulted mainly from the restriction of activity and pain which result in decreased quality of life. About 80% of OA patients have some degree of activity limitation with 20% reported frank limitation in performing major daily living activities. Meanwhile, 11% of OA patients are requiring personal care.^{3,5}

OA could be managed by surgical approach or non-surgical one.⁶ However, in most of the case, OA is managed non-surgically which could be differentiated into pharmacological and non-pharmacological approach.⁷ However, little review represents the current advance in non-surgical management of OA which hamper the quality improvement of OA management. Thus, the aim of this review is to describe the non-surgical managements of OA as well as recent advances in it. Hopefully, the information could enhance and develop the current management of OA toward a more comprehensive approach.

OSTEOARTHRITIS: A GENERAL REVIEW

The clinical presentations of OA are dependent on the location of the disease. Limitation of the range of movement (ROM) is commonly found along with crepitation sound when the joint moved. Knee OA could be accompanied with local joint tenderness while limitation in internal hip rotation and groin and inner thigh pain indicate a hip OA. However, in order to establish the definitive diagnosis, supporting diagnoses are required. Radiologic examination is widely used while laboratory examinations are useful in excluding the differential diagnoses (Rheumatoid Arthritis and Gout Arthritis). To simplify the process, the classification criteria of OA represented by American College of Rheumatology (ACR) could be helpful to differentiate the hip and knee OA.^{8,9}

¹Medical Rehabilitation Department Sanglah General Hospital

²Doctoral Program Faculty of Medicine, Udayana University, Bali-Indonesia

*Correspondence to:
Cok Gede Dalem Kurniawan, Medical Rehabilitation Department Sanglah General Hospital, Doctoral Program Faculty of Medicine, Udayana University, Bali-Indonesia
cd_kur@yahoo.com

Received: 2018-02-28

Accepted: 2018-3-8

Published: 2018-3-9

ACR criteria for the diagnosis of hip OA		
Combined clinical and radiographic criteria (traditional format)	Clinical criteria (tree format)	Combined clinical and radiographic criteria (tree format)
Hip pain plus at least 2 of the following: ESR < 20 mm/h, radiographic femoral or acetabular osteophytes, radiographic joint-space narrowing (superior, axial, and/or medial)	Hip pain AND hip internal rotation < 15° AND ESR < 45 mm/h (if ESR is not available, use hip flexion < 115°) OR hip internal rotation ≥ 15° AND pain on hip internal rotation AND morning stiffness < 60 minutes AND age > 50 years	Hip pain AND femoral and/or acetabular osteophytes on radiograph OR ESR ≤ 20 mm/h AND axial joint-space narrowing on radiographs
Sensitivity, 89% Specificity, 91%	Sensitivity, 86% Specificity, 75%	Sensitivity, 91% Specificity, 89%

ACR, American College of Rheumatology; OA, osteoarthritis; ESR, erythrocyte sedimentation rate.

ACR criteria for the diagnosis of knee OA		
Clinical and laboratory	Clinical and radiographic	Clinical
Knee pain plus at least 5 of the following: age > 50 years, stiffness < 30 minutes, crepitus, bony tenderness, bony enlargement, no palpable warmth, ESR < 40 mm/h, RF < 1:40, synovial fluid consistent with OA*	Knee pain plus at least 1 of the following: age > 50 years, stiffness < 30 minutes, crepitus—plus osteophytes	Knee pain plus at least 3 of the following: age > 50 years, stiffness < 30 minutes, crepitus, bony tenderness, bony enlargement, no palpable warmth
Sensitivity, 92% Specificity, 75%	Sensitivity, 91% Specificity, 86%	Sensitivity, 95% Specificity, 69%

ACR, American College of Rheumatology; OA, osteoarthritis; ESR, erythrocyte sedimentation rate; RF, rheumatoid factor.
* OA synovial fluid should have white blood cell count < 2000/μL.

Figure 1 ACR criteria for knee and hip Osteoarthritis^{8,9}

The severity of OA depends on the number of joint affected and the degree of the disease itself. Single joint OA usually posed only local structural and functional problem but often enough to cause some limitation in daily activity. The pain also results in increased tonus of the surrounding musculatures and, thus, changes in movement and gait as well as daily activity restriction. Long lasting symptoms untreatable or poorly treatable disease could lead to marked decreased in joint ROM, deconditioning of musculoskeletal and cardiovascular system, somatosensory abnormalities, and increased risk of falling. Restriction in daily activity may hamper the social activity, resulting in increased degree of social isolation. On the other hand, activity restriction and chronic pain could result in depression and sleep disturbances. Elderly people with comorbidities tend to experience greatest effect since they generally already depend on the others. Thus, OA could exacerbate the loss of self-dependence in this population and increase the burden for the whole family. The functional status of OA patients in executing the daily living activities can be assessed by using International Classification of Functioning (ICF) core which is already sets for OA.¹⁰

Besides the clinical aspects, the capability, potential and prognosis of rehabilitation process that would be applied to the patient is also need to be evaluated. Some parameters can be used such as The Western Ontario and McMaster Universities OA Index (WOMAC), Lower Extremity Function Scale (LEFS), and the Hip and Knee Osteoarthritis Outcome Score (HOOS, and KOOS). The rehabilitation approach in OA aimed to provided holistic approaches in complex management of OA by using personalization medicine in addressing local problem, the activity restriction, comorbidities and other factors that may affect symptoms improvement.^{11,12}

NON-PHARMACOLOGIC REHABILITATIVE INTERVENTION

Exercise for OA patient

Almost all international guidelines select exercise as the first-line management for OA patients. Exercise is regarded as the management option that could improve the physical function of patient with knee OA while just had moderate effect in reducing pain. However, the pain relieving effect of exercise was found to be similar to simple analgesia or non-steroidal anti-inflammatory drugs but had lower risk of side effects. Meanwhile, exercise does not bring the same treatment effect in hip OA. Evidences showed that exercise had low pain relieving and physical function properties but newer study revealed that exercise still had significant beneficial effect for symptomatic patient with hip OA. Overall, therapeutic exercises showed promising benefit in reducing the pain level in OA patient especially those which incorporate strengthening elements. In addition, in order to enhance the effectiveness of exercise, it could be initiated with *aquatic exercise* which could reduce the joint load and, thus, minimizes the pain exacerbation. The benefit of this method has been documented both in knee and hip OA.¹³

Regarding it effectiveness, exercise should be recommended and advised to all OA patients since exercises cover several aspect of training. Since knee OA commonly associated with progressive muscle atrophy, resistance training should be recommended to all of them. The urgency of muscle weakness or atrophy is quite significant since it is associated with increased degree of pain and functionality of knee joint that potentially hamper the daily activity of the patients. The training also proved to significantly decreases the narrowing of knee joint compared to ROM exercise. However, several other studies failed to find any significant improvement. Nevertheless, it seems that isokinetic training is more accepted and suitable for such patient compared to concentric training. On the other hand, no difference has been observed between high and low resistance training which indicates that both regiments have the same effectiveness in reducing pain, increasing functionality and muscle strength as well as daily activity.^{14,15}

The other aspect of exercise training for OA is aerobic training which is beneficial in improving the aerobic capacity of OA patients. The improvement in aerobic capacity is an important aspect in OA management since most OA patients have deconditioning state due to lack of movement. It also augments the muscle strengthening properties of resistance training which would bring beneficial effects as stated before. The evidence of such benefit

was strengthened by OARSI recommendation study which revealed that aerobic exercise improve the outcome of OA patients measured in walking and chair-raise test.¹⁶

There is also *Flexibility (ROM) exercises* which generally increase muscles length and elasticity as well as peri-articular tissues. However, there is a slightly different aim of such exercise in OA patient which is aim to reduce the degree of stiffness, enhancing joint mobility, and prevent contractures formation. This method rarely stands for itself and usually combined with the other two exercise methods. Therefore, there is no report that exclusively evaluated the effectiveness of ROM training in OA patient. However, as part of other methods of exercise, it proved to be effective in improving symptoms of OA but has little effect to those who have near optimal social function in the community. Tai chi is one of the popular ROM exercises among OA patients but the data that evaluate the outcome is sparse. Thus, no conclusion could be drawn regarding the recommendation of ROM exercise for OA patient.¹⁷

In its application, exercise could be performed in group to enhance patient's motivation to treatment. Despite the effectiveness of all exercise methods, the frequency and accuracy of the techniques still bring significant differences compared to irregular and unsupervised training.¹⁸ Supervising also enhance the safety of the methods despite the fact that all three methods are generally safe and well tolerated by the patients. Nevertheless, it is important to educate the patients about daily variability of the disease and over-exercise could bring harm to patient itself and manifest as intensifying of pain during activity, lasting longer than 1 or 2 hours, edema, weakness and muscle fatigue.¹⁹ However, the education should not instill fear of activity to the patient since it is often associated with poor treatment response.

In general, exercise is a core recommendation in OA guidelines both for knee and hip OA and has both short and long term beneficial effect in patient functionality.¹³ In case of hip OA, the exercise had little effect in improving physical function but could significantly reduce the pain. The application of exercise in OA is well regulated by American Geriatrics Society Panel on Exercise and Osteoarthritis which stated that the program should include flexibility, endurance and strength improvement in order to optimize the functional improvement.²⁰

Weight Loss Program

Overweight patient with knee OA should be advised to engage the weight loss program since the body weight itself posed significant burden to the knee

and other weight bearing joints. The effect size of the weight loss in OA management study ranged from 0.2 to 0.23 which is estimated based on the physical function and the degree of pain. Combining weight loss with exercise has significantly larger effect compared to exercise or weight loss alone since it is improved the quantity and quality of joint cartilage. Thus, weight loss is strongly recommended in OA management guidelines.^{21,22}

Physical Therapy HEAT AND COOLING

Heating has both comforting and therapeutic effect for OA patient since it could reduce pain sensation while enhance the expression of heat shock protein 70 (HSP 70) at the same time. HSP 70 has a significant role in cartilage protection, reducing inflammation, and prevents apoptosis of chondrocytes. It also improve matrix metabolism which enhance matrix renewal. Meanwhile, the functionality of superficial cold treatment is only limited to pain reduction so far. Which treatment that should be applied depends on patient interest and the patient should try them both and decide which treatment brings the greatest relief.²³

NEUROMUSCULAR ELECTRICAL STIMULATION (NMES)

The application of neuromuscular electrical stimulation (NMES) for women with mild and moderate OA of the knee is still controversial. So far, NMES was proved insufficient to induce quadriceps muscle strengthening [36]. Even if the patient requires daily NMES application to gain such effects, the protocol of this approach seems to be insufficient which is applied 3 times a week for 30 minutes each. Even the Cochrane Review reported no improvement isometric strength despite evidence of a better activation of quadriceps muscle.²⁴

PULSED ELECTROMAGNETIC FIELD THERAPY (PEMF)

PEMF application in OA management has significantly improved the patient's daily activity, according to the meta-analysis of the PEMF RCT. However, no improvement was observed in pain and stiffness reduction. The management guidelines of OA recommend PEMF as adjuvant therapy for knee OA despite many studies failed to show its effect in pain reduction. Physiotherapy which includes stretching, ROM, and resistance exercise showed comparable effect to PEMF in decreasing pain severity and functionality improvement but physiotherapy has much lower cost. Thus, the application of PEMF could be replaced by physiotherapy at least in some cases.²⁵

ULTRASOUND

The application of ultrasound for knee and hip OA is also still controversial due to low quality of the evidence. However, some studies showed promising findings regarding the application of this management method in OA. Cochrane review showed that ultrasound might be had beneficial effect for knee OA but the evidences used in the review were not convincing. Some studies also found that ultrasound improve pain perception, ROM, decrease inflammation and edema of the knee joint compared to sham group. However, multimodal study failed to replicate these results. In general, those studies recommend ultrasound for hip OA and regard it as a safe, applicable, and affordable therapeutic option for most OA patients.²⁶

TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION

Transcutaneous electrical nerve stimulation (TENS) has been used as pain relieved in many management of pain related medical conditions. The TENS is considered to be highly effective in reducing pain and usually applied in condition with chronic pain or when pharmacological intervention has failed. The TENS has also been proven in OA with pain reduction reported in all session of treatment using TENS even with low frequency. Combining TENS with exercise greatly improved the outcome with significant reduction in pain and increased activation of quadriceps muscle and, thus, higher quality of daily activity function.²⁷

LOW-LEVEL LASER THERAPY

The combination of Low-level laser therapy (LLL) with exercise has been proven to reduce the pain level and improving functionality and activity in knee OA. The radiation also enhances local microcirculation and highly recommended in OA management of adjunctive therapy.²⁸

MASSAGE

Massage also could be used in OA management. Massage for sixty minutes per week has proved to improving pain management and WOMAC functionality score after 8 weeks of treatment. However, no difference was observed after 24 weeks compared to conventional treatment. Of note, stimulating massage of the quadriceps femoris, gracilis, sartorius, and the hamstrings did not help in the repositioning of the effected knee joint.²⁹

ACUPUNCTURE

Despite its effectiveness, the application of acupuncture in OA management still required further study

to be validated. Some of the effect might result from patient's expectation or placebo effect and even pain relieve which lead to better posture outcome. It also partially depends on the acupuncturist which could have different experience. Thus, further study should be conducted to evaluate its true effectiveness by using double blind design so its application could be validated.³⁰

ASSISTIVE DEVICES

Canes

Canes are a common device used to assist the movement of OA patients. The energy expenditure of the patients tends to increase when the first time using it. However, after 1 month, beneficial effect of using canes could be observed as significant pain reductions and the energy expenditure is also back to normal level due to the adaptation. To significantly reduce the burden of the affected knee and optimize the benefit, the cane should be used contra-laterally. However, it application in hip OA could not bring the same effect and, thus, limited just for patients with knee OA.³¹

Braces and Insoles

For the medial knee OA, the use of lateral wedges reduces the knee-ground reaction force lever arm, which seems to be the central mechanism of the load-reducing effects. To better understand why some patients do not respond to the treatment, further evaluation of patient characteristics are needed. A recent study compared the biochemical and clinical effects of valgus knee braces and lateral wedged insoles. Lateral insoles were better accepted by patients. By reducing the knee loading in OA, both treatments could slow the speed of progression of OA. Using valgus unloader braces, activity levels are positively influenced. Muscle strength improved for the hamstrings and did not result in any muscle impairment after a 6-month period. For hip OA, the wearing of a brace of the WISH-type shows a positive effect on the turning phase of the Timed Up and Go Test. This result could be accomplished with or without the application of the brace at the assessment. This effect could be due to daily exercise. The wearing of braces and insoles is recommended by the American College of Rheumatology 2012.^{32,33}

CONCLUSION

There are diverse options in non-pharmacologic management of OA patients that could be used to improve the outcome of OA management. These approaches should be used in conjunction with surgical or pharmacological intervention for

better result and only used alone in patient with mild symptoms. Nevertheless, some of the methods describe above still have poor evidences to be recommended and thus need further research to validate its usage among OA patients.

REFERENCES

- Sharma L. Osteoarthritis Year in Review 2015: Clinical. *Osteoarthritis and cartilage / OARS, Osteoarthritis Research Society*. 2016;24(1):36-48.
- Helme RD, Gibson SJ. The epidemiology of pain in elderly people. *Clin Geriatr Med*. 2001;17(3):417-431
- Zhang W, Moskowitz RW, Nuki G, et al. OARSI recommendations for the management of hip and knee osteoarthritis, Part II: OARSI evidence-based, expert consensus guidelines. *Osteoarthritis Cartilage*. 2008;16:137-62
- Hochberg MC, Altman RD, April TK, et al. American college of rheumatology 2012 recommendations for the use of nonpharmacologic and pharmacologic therapies in osteoarthritis of the hand, hip, and knee. *Arthritis Care Res*. 2012;64:465-74
- Roos EM, Lohmander LS. The Knee injury and Osteoarthritis Outcome Score (KOOS): from joint injury to osteoarthritis. *Health Qual Life Outcomes*. 2003;1:64-71
- Sakalauskiene G, Jauniškiene D. Osteoarthritis: etiology, epidemiology, impact on the individual and society and the main principles of management. *Medicina (Kaunas)*. 2010;46(11):790-7
- Pinto D, Robertson MC, Hansen P, Abbott JH. Cost-effectiveness of nonpharmacologic, nonsurgical interventions for hip and/or knee osteoarthritis: systematic review. *Value Health*. 2012 Jan;15(1):1-12
- Altman R, Asch E, Bloch D, et al. Development of criteria for the classification and reporting of osteoarthritis. Classification of osteoarthritis of the knee. *Arthritis Rheum*. 1986;29:1039-49.
- Altman R, Alarcon G, Appelrouth D, et al. The American College of Rheumatology criteria for the classification and reporting of osteoarthritis of the hip. *Arthritis Rheum*. 1991;34:505-14.
- Dreinhöfer K, Stucki G, Ewert T, et al. ICF core sets for osteoarthritis. *J Rehabil Med*. 2004;(Suppl 44):75-80
- Bellamy N. WOMAC osteoarthritis index. A user's guide. London University of Western Ontario; 1995.
- Roos EM, Lohmander LS. The Knee injury and Osteoarthritis Outcome Score (KOOS): from joint injury to osteoarthritis. *Health Qual Life Outcomes*. 2003;1:64-71
- Fransen M, McConnell S, Hernandez-Molina G, et al. Does land-based exercise reduce pain and disability associated with hip osteoarthritis? A meta-analysis of randomized controlled trials. *Osteoarthritis Cartilage*. 2010;18:613-20.
- Foroughi N, Smith RM, Lange AK, et al. Progressive resistance training and dynamic alignment in osteoarthritis: a single-blind randomized controlled trial. *Clin Biomech*. 2011;26:71-7.
- Jan MH, Lin JJ, Liao JJ, et al. Investigation of clinical effects of high- and low-resistance training for patients with knee osteoarthritis: a randomized controlled trial. *Phys Ther*. 2008;88:427-36.
- Zhang W, Nuki G, Moskowitz RW, et al. OARSI recommendations for the management of hip and knee osteoarthritis Part III: changes in evidence following systematic cumulative update of research published through January 2009. *Osteoarthritis Cartilage*. 2010;18:476-99.
- Fitzgerald GK, Piva SR, Gil AB, et al. Agility and perturbation training techniques in exercise therapy for reducing pain and improving function in people with knee osteoarthritis: a randomized clinical trial. *Physical Therapy*. 2011;91:452-69
- Fransen M, Mc Connell S. Exercise for osteoarthritis of the knee. *Cochrane Database Syst Rev*. 2009;CD007912
- Fitzgerald GK, White DK, Piva S, et al. Associations for change in physical and psychological factors and treatment response following exercise in knee osteoarthritis: an explorative study. *Arthritis Care Res*. 2012;64(11):1673-80.
- American Geriatrics Society Panel on Exercise and Osteoarthritis. Exercise prescription for older adults with osteoarthritis pain: consensus practice recommendations. *J Am Geriatr Soc*. 2001;49:808-23.
- Anandacoomarasamy A, Leibman S, Smith G, et al. Weight loss in obese people has structure-modifying effects on medial but not on lateral knee articular cartilage. *Ann Rheum Dis*. 2012;71:26-32.
- Messier S, Loeser R, Miller G, et al. Exercise and dietary weight loss in overweight and obese older adults with knee osteoarthritis. *Arthritis Rheum*. 2008;50:1501-10
- Yildirim N, Filiz Ulusoy M, Bodur H. The effect of heat application on pain, stiffness, physical function and quality of life in patients with knee osteoarthritis. *J Clin Nurs*. 2010;19:1113-20.
- Palmieri-Smith RM, Thomas AC, Karvonen-Gutierrez C, Sowers M. A clinical trial of neuromuscular electrical stimulation in improving quadriceps muscle strength and activation among women with mild and moderate osteoarthritis. *Phys Ther*. 2010;90:1441-52.
- Gremion G, Gaillard D, Leyvraz PF, Jolles BM. Effect of biomagnetic therapy versus physiotherapy for treatment of knee osteoarthritis: a randomized controlled trial. *BMJ Rehabil Med*. 2009;41:1090-5.
- Ulus Y, Tander B, Akyol Y, Durmus D, Buyukakincak O, Gul U, Canturk F, Bilgici A, Kuru O. Therapeutic ultrasound versus sham ultrasound for the management of patients with knee osteoarthritis: a randomized double-blind controlled clinical study. *Int J Rheum Dis*. 2012;15:197-206
- Vance CG, Rakel BA, Blodgett NP, DeSantana JM, Amendola A, Zimmerman MB, Walsh DM, Sluka KA. Effects of transcutaneous electrical nerve stimulation on pain, pain sensitivity, and function in people with knee osteoarthritis: a randomized controlled trial. *Phys Ther*. 2012;92:898-910
- Alfredo PP, Bjordal JM, Dreyer SH, Meneses SR, Zaguetti G, Ovanessian V, Fukuda TY, Junior WS, Martins RA, Casarotto RA, Marques AP. Efficacy of low level laser therapy associated with exercises in knee osteoarthritis: a randomized double-blind study. *Clin Rehabil*. 2012;26:523-33
- Perlman AI, Ali A, Njike VY, Hom D, Davidi A, Gould-Fogerite S, Milak C, Katz DL. Massage therapy for osteoarthritis of the knee: a randomized dose-finding trial. *PLoS One*. 2012;7(2):e30248.
- Suarez-Almazor ME, Looney C, Liu Y, Cox V, Pietz K, Marcus DM, Street RL Jr. A randomized controlled trial of acupuncture for osteoarthritis of the knee: effects of patient-provider communication. *Arthritis Care Res*. 2010;62:1229-36
- Jones A, Silva PG, Silva AC, Colucci M, Tuffanin A, Jardim JR, Natour J. Impact of cane use on pain, function, general health and energy expenditure during gait in patients with knee osteoarthritis: a randomised controlled trial. *Ann Rheum Dis*. 2012;71:172-9.
- Hinman RS, Bowles KA, Metcalf BB, Wrigley TV, Bennell KL. Lateral wedge insoles for medial knee osteoarthritis: effects on lower limb frontal plane biomechanics. *Clin Biomech (Bristol, Avon)*. 2012 Jan;27(1):27-33
- Sato E, Sato T, Yamaji T, Watanabe H. Effect of the WISH type hip brace on functional mobility in patients with osteoarthritis of the hip: evaluation using the timed up & go test. *Prosthet Orthot Int*. 2012;36:25-32.



This work is licensed under a Creative Commons Attribution