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Integrated Treatment of Yoga, Naturopathy and Physiotherapy in Reducing Pain and Improving Functional Status of Osteoarthritis Patients

Dr. Rukamani Nair, Dr. Gaurav Kaushik, Dr. V. N. Gaur, Dr Ravi Pratap Singh

[1]Medical Superintendent, Bapu Nature Cure Hospital and Yogashram, Mayur Vihar Phase I, Delhi-110091, India

[2](Ph.D), Research Coordinator, Bapu Nature Cure Hospital and Yogashram, Mayur Vihar Phase I, Delhi-110091, India

[3]Gaur, Orthopedic Surgeon, Ramlal Kundanlal Hospital, Pandav Nagar, Delhi, 110092, India

[4]Physiotherapist, Bapu Nature Cure Hospital and Yogashram, Mayur Vihar Phase I, Delhi-110091, India

Abstract: ***Osteoarthritis of Knees (OA Knees) also known as degenerative arthritis or degenerative joint disease is a group of mechanical abnormalities involving degradation of joints, including articular cartilage and subchondral bone. The aim of the study focuses on reduction of symptoms and increase in functional activities of elderly patients with osteoarthritis of knees before and after modalities of yoga, naturopathy and physiotherapy. A total 43 patients were recruited and divided into two Groups. Group I (control group) were on allopathic medicines (called once in a month for one year follow-up) and Group II (intervention group) (called 64 times for one year follow-up) were on Yoga, Naturopathy, Physiotherapy and diet control. The study parameters were assessed at baseline and at 12th month follow-up. Results found in this study shows an improvement in pain, 50 foot walk test, morning stiffness, swelling, SF-12, Vitamin D3 level, MMT and ROM after taking one year of allopathic medicines in group I and Yoga, Naturopathy and Physiotherapy treatment with diet control in group II. In conclusion, a combined package of Yoga, Naturopathy and Physiotherapy with diet control is found to be effective in reducing pain, facilitating improvement in functional status of elderly people suffering from Osteoarthritis of Knees.***

Keywords: Osteoarthritis of Knees, Yoga, Naturopathy, Physiotherapy

1. Introduction

Osteoarthritis (OA) is considered to be the most common form of arthritis in a large number of people older than 60 years. This results in structural and functional failure of synovial joints (1-3). The clinical features of OA include joint pain with limited activity, morning stiffness, restricted motion, joint crepitus, periarticular tenderness, bony swelling and functional disability (4). Knee OA is more commonly associated with disability than OA of any other joint. Risk factors of OA of the knee include older age, females, obesity, osteoporosis, occupation, sports activities, previous trauma, muscle weakness or dysfunction and genetic factors (5).

Osteoarthritis of the hip or knee is particularly disabling activities because it limits ambulation, but the affliction also strikes the hands, the spine and the feet with the same destructive joint process (6-9). The end point of the OA disease process is total loss of joint cartilage in the affected area and the need for joint replacement. Recent studies have focused on etiological factors and separated them into three main subgroups: sex, anatomy and body mass. The clinical manifestations of OA knees include joint pain, stiffness, decreased range of joint movement, weakness of the quadriceps muscle and alterations in proprioception. Decreased strength in the joint muscle significantly causes a progressive loss of function. These symptoms restrict an individual's ability to get up from a chair, walk or climb stairs (10-11).There is indication that muscle dysfunction is involved in the pathogenesis of knee OA (12-13).

Globally, OA is the eighth leading cause of disability (14) and Knee OA is more commonly associated with disability than OA of any other joint (15). OA is affecting quality of life extensively with increase in mood impairment, sleep disturbance, comorbid diseases, risk for falls and substantial economic and health care burdens (16-22). Till now, there is no cure for OA, as it is extremely difficult to restore the lost cartilage (23).

The aim of treatment is to reduce pain, improve joint mobility, increase the muscle strength of the joints and minimize the disabling effects of the disease (24-28). The WHO Scientific Group on Rheumatic Diseases estimates that 10% of the world's population who are 60 years or older have significant clinical problems that can be attributed to OA (29). Worldwide prevalence rate of OA is 20% for men, 41% for women, however, in India overall prevalence of OA is 22-39%.

The purpose of the present study was to assess the effect of Yoga, Naturopathy and Physiotherapy with diet control in reducing pain and improving functional status in patients with OA of Knees. Recent studies show that mind-body therapies may alleviate the symptoms associated with OA of Knees. There is growing evidence which suggest that meditative practices can decrease pain, reduce other distressful symptoms, and enhance both physical and physiological functions in a broad range of populations (30, 31).

It is increasingly recognized that in complementary medicine, Yoga is a complete system of lifestyle, philosophy

and personal health practices based on ancient Indian traditions (32). Yoga is a form of mind-body fitness that involves a combination of poses, breathing techniques and meditation which can reduce pain and stiffness associated with OA by realigning the skeletal structure, strengthening muscles around the joints and stretching tight joint structures (33). It is believed that frequent joint motion during yoga practices has physiological effects at the cellular level.

Massage therapy may reduce symptoms and improve the course of OA by increasing local circulation to the affected joint, musculature improvement, increasing joint flexibility and relieving pain (34). Massage therapy has been found to be effective after evaluating for various painful musculoskeletal conditions (35, 36). So far, no study has specifically evaluated the effectiveness of massage therapy for OA knees. Modern medicines are the treatment mainstay for up to 78% of OA patients (37-39). Unfortunately, medications used to control OA pain have significant side-effects in older adults which increase the health risk extensively (40, 41).

The Yoga, Naturopathy and Physiotherapy supported by diet control are safe and feasible self-manageable interventions that will help in improving their quality of life by making it a part of their daily living. The practice of Naturopathy, Yoga and Physiotherapy may play an important role in reducing stress and frustration that results from pain and disability by increasing positive feelings and wellbeing. Present study aimed that, when combined with a program of good medical care, Yoga, Naturopathy, Diet and Physiotherapy may provide physical and psychological health benefits for OA of knees patients.

2. Methodology

Present study was conducted at Science, Research and Innovation Department of Bapu Nature Cure Hospital and Yogashram. Patients were recruited through advertisements in wall posters, news paper advertisements, banners, organizing camps in nearby localities of the Hospital and from the Hospital OPD. All patients were more than 60 years of age. Adequate counseling was carried out for the disease awareness as well as about the study trial. Eligible patients were recruited after taking consent according to the inclusion and exclusion criteria as per American College of Osteoarthritis Association guidelines. The total period of recruitment of patients was 6 months.

Randomization

A total number of **43** patients were recruited from different localities. These patients were divided randomly into two Groups. Group I (control group) includes 15 patients (male, n=02, female, n=13) were on allopathic medicines and Group II (Intervention group) includes 28 patients (male, n=10, female, n=18) were on therapy i.e. Yoga, Naturopathy, Physiotherapy and diet control. Before starting the trial, intensive counseling was done to educate them about the disease and its risk factors, about the benefits of the treatment of Yoga, Naturopathy, Physiotherapy and diet control, about drugs, X-ray, number of treatment visits to the Hospital and about the parameters to be investigated during the study period.

Design of the study

This was a Case Control study in which Yoga, Naturopathy and Physiotherapy treatments were provided to the intervention group twice in a week for first 4 months and once in a week for next 8 months. The total number of visits by a patient in one year follow-up was 64. Medicines provided to the control group were called once in a month for one year follow-up. The study parameters i.e. Symptoms score (morning stiffness, joint pain, swelling), Physical examination using manual muscle testing (MMT), Range of Motion (ROM), 50 foot walk test, functional status by using SF-12 and Serum Vitamin D3 level were assessed at baseline and at 12th month follow-up.

Treatment

Yoga & Naturopathy modalities with Physiotherapy modules were provided to the intervention group not only to control the disease but also to maintain the healthiness and fitness. After baseline investigations, intensive information, education and counseling about the disease and the benefits of above treatment was given to all the patients. They were also explained about the factors responsible for the causation of the disease and how it affects different systems of the body. The total treatment duration of yoga, naturopathy and physiotherapy was 1 hour and 11 minutes per sitting.

Yoga

Duration of Yoga practices was for 15 minutes. The expected benefits of yoga on such diseases are to reduce inflammation, joint stiffness, joint pain and to increase the range of motion and blood circulation.

Yoga therapies
1) Tadasana
2) Utakatasana
3) Konasana
4) Uttanpadasana
5) Salabhasana
6) Nadi Shodhana Pranayama
7) Brahmari Pranayama

Naturopathy treatments

Duration of Naturopathy treatment was for 33 minutes. Following are the treatments:

1) Leg Massage (15 mins)
Massage is a therapeutic maneuver which is skillfully applied to the joint muscles of the knees and other parts of the legs. Massage promotes:
i. Nourishment and development of the muscles & bones.
ii. Excites muscular contractions.
iii. Removes the effects of muscular fatigue.
iv. Decreases the stiffness and soreness of muscles.

2) Hot and Cold Compress (Temp Hot 42^0-45^0C, Cold 18-27^0C) for (18 min)
Hot water bag cotton cloth wrung in hot water, a cold compress and a dry cloth were used.

Physiotherapy treatments: Duration of Physiotherapy treatment was for 22 minutes.

1. Interferential therapy
2. Ultrasonic therapy
3. Isometric exercise
4. Strengthening exercise

Statistical Methods

The data obtained in the study was analyzed by using SPSS. For comparison from 12th month to baseline, Paired T Test was performed. For non parametric method Chi-square test was performed. Results of Pain (VAS) & Vitamin D3 are expressed as mean ± standard deviation (SD). The p value (<0.05) was considered to be statistically significant.

3. Results

Forty three OA Knees patients were recruited in this study. All the patients have completed their one year follow-up.

Morning stiffness: There was significant improvement observed in morning stiffness of Intervention group where patients had shifted from mild, moderate and severe to normal category at 12th month as compared to baseline (p<0.001). In Control group, patients were shifted from severe category to normal category, however, the difference was not statistically significant at 12th month as compared to baseline (p=0.06) Table 1.

SF-12: On comparing SF-12 status in both the groups, significant improvement (p<0.001) was observed in intervention group as more patients were shifted from moderate and severe category to mild category at 12th month as compared to 0 day. However, no significant difference was observed at 12th month compared to 0 day in group I patients (Table 1).

Table 1: Comparison of morning stiffness and SF-12 at baseline and after 12th month Follow-up in both the groups

	Group I (n=15)	*Baseline*	*After one year treatment*	*P value*
Morning stiffness	Normal (%)	0	3	0.069
	Mild (%)	6	6	
	Moderate (%)	6	7	
	Severe (%)	4	0	
SF-12	Mild (%)	1	5	0.012
	Moderate (%)	9	11	
	Severe (%)	6	0	
	Group II (n=28)	**Baseline**	**After one year treatment**	**P value**
Morning stiffness	Normal (%)	6	23	<0.001
	Mild (%)	5	5	
	Moderate (%)	12	0	
	Severe (%)	5	0	
SF-12	Mild (%)	3	21	<0.001
	Moderate (%)	19	7	
	Severe (%)	6	0	

Pain (VAS): Pain reduction was observed at 12th month time as compared to baseline in both the groups (Table 2).

Table 2: Comparison of Pain (VAS) at baseline and after 12th month Follow-up

Group-I	Baseline	12th month	P value
VAS % (Mean± SD)	61.87±15.15	40.62±14.36	<0.001
Group II VAS % (Mean± SD)	54.64±15.51	8.57±7.55	<0.001

Swelling: On comparing swelling in both the groups, significant improvement was observed at 12th month as compared to 0 day in group-II patients (p<0.001). In group I, no significant difference was observed in swelling at 12th month as compared to 0 day (p=0.70), (Table 3).

Table 3: Comparison of Swelling at baseline and after 12th month Follow-up

Group-I	Baseline	12th month	P value
Present	12	10	0.70
Absent	04	06	
Group II			
Present	15	1	<0.001
Absent	13	27	

Vitamin D3: Significant improvement in Vitamin D3 level was also observed at 12th month (37.22±15.45) follow-up as compared to baseline (13.19±11.17) in group I patients as well as 29.41±14.72 at 12th month compared to 21.07±13.96 at baseline in group II patients (p<0.003), (Table 4).

Table 4: Comparison of Vitamin D3 level at baseline and at 12th month follow-up

Group-I	Baseline	12th month	P value
Baseline, median (range)	13.19±11.17	37.22±15.45	<0.001
Group II Baseline, median (range)	21.07±13.96	29.41±14.72	<0.014

MMT: MMT parameters like quadriceps and hamstring shows statistically significant improvement in intervention group patients after 1 year of treatment (p<0.001). In control group, significant difference was observed in Right Quadriceps (p=0.03) and Right Hamstring (p=0.02) at 12th month follow-up as compared to 0 day (Table 5, 6).

Table 5: MMT status at 12th month follow-up compared to baseline in group II patients

MMT (Group II, n=28)		*Baseline*	*12th*	*p value*
Quadriceps Right	Very	2	0	<0.001
	Fair	11	0	
	Very Fair	9	0	
	Good	5	0	
	Very	1	6	
	Normal	0	22	
Quadriceps Left	Very	5	0	<0.001
	Fair	10	0	
	Very fair	7	0	
	Good	4	0	
	Very	2	8	
	Normal	0	20	
Hamstring Right	Very	0	0	<0.001
	Fair	17	0	
	Very fair	7	0	
	Good	4	0	
	Very good	0	2	
	Normal	0	26	
Hamstring	Very poor	4	0	<0.001
	Fair	14	0	

Left	Very fair	9	0	
	Good	0	0	
	Very good	1	2	
	Normal	0	26	

Table 6: MMT status at 12th month follow-up compared to baseline in group I patients

MMT (Group I, n=15)		*Baseline*	*12th month*	*p value*
Quadriceps Right	Poor	2	0	0.033
	Fair	4	0	
	Very Fair	9	13	
	Good	0	2	
	Very good	0	0	
	Normal	0	0	
Quadriceps Left	Poor	1	0	0.184
	Fair	9	5	
	Very fair	5	8	
	Good	0	2	
	Very good	0	0	
	Normal	0	0	
Hamstring Right	Poor	3	0	0.020
	Fair	7	2	
	Very fair	4	12	
	Good	1	1	
	Very good	0	0	
	Normal	0	0	
Hamstring Left	Poor	2	0	0.125
	Fair	9	5	
	Very fair	3	7	
	Good	1	3	
	Very good	0	0	
	Normal	0	0	

ROM: On analyzing ROM for knee joints, it was observed that significant number of patients have shifted to 0-130^0 in flexion left and flexion right and 130-0^0 in extension left and extension right at 12th month as compared to baseline in group II patients Table 7.

Table 7: ROM status at 12th month follow-up compared to baseline in group II patients

ROM (Group II, n=28)		*Baseline*	*12th month*	*p value*
Flexion left	0-50^0	3	0	<0.001
	0-80^0	20	0	
	0-120^0	5	6	
	0-130^0	0	22	
Flexion right	0-50^0	3	0	<0.001
	0-80^0	18	0	
	0-120^0	7	4	
	0-130^0	0	24	
Extension left	50-0^0	3	0	<0.001
	80-0^0	20	0	
	120-0^0	5	10	
	130-0^0	0	18	
Extension right	50-0^0	3	0	<0.001
	80-0^0	18	0	
	120-0^0	7	7	
	130-0^0	0	21	

For group I patients, significant number of patients have shifted to 0-120^0 in flexion right and 120-0 in extension right at 12th month as compared to baseline in group II patients, however, no significant difference was observed in flexion left and extension left assessment at 12th month as compared to baseline Table 8.

Table 8: ROM status at 12th month follow-up compared to baseline in group I patients

ROM (Group I, n=15)		*Baseline*	*12th month*	***p value***
Flexion left	0-50^0	1	1	0.166
	0-80^0	10	5	
	0-120^0	4	9	
	0-130^0	0	0	
Flexion right	0-50^0	2	1	0.035
	0-80^0	10	4	
	0-120^0	3	10	
	0-130^0	0	0	
Extension left	50-0^0	1	1	0.166
	80-0^0	10	5	
	120-0^0	4	9	
	130-0^0	0	0	
Extension right	50-0^0	2	1	0.035
	80-0^0	10	4	
	120-0^0	3	10	
	130-0^0	0	0	

50 foot walk test: On comparing 50 foot walk test in group II patients, significant number of patients were able to complete the walk in <15 seconds at 12th month time point as compared to baseline, however, in group I patients significant number of patients were able to complete the walk between 15.1-20 seconds at 12th month as compared to baseline Table 9, 10.

Table 9: 50 foot walk test status at 12th month follow-up compared to baseline in group II patients

50 foot walk test (Group II, n=28)	*Baseline*	*12th month*	*p value*
Unable	2	0	<0.001
>25 sec	6	0	
20.1-25 sec	11	0	
15.1-20 sec	8	4	
≤15 sec	1	24	

Table 10: 50 foot walk test status at 12th month follow-up compared to baseline in group I patients

50 foot walk test (Group I, n=15)	*Baseline*	*12th month*	*p value*
Unable	1	0	0.030
>25 sec	5	0	
20.1-25 sec	7	6	
15.1-20 sec	2	8	
≤15 sec	0	1	

4. Discussion

Results obtained in this study shows an improvement in pain, 50 foot walk test, morning stiffness, swelling, SF-12, Vitamin D3 level, MMT and ROM after taking one year of allopathic medicines in group I and Yoga, Naturopathy and Physiotherapy treatments with diet control in group II.

These observations indicate that Yoga, Naturopathy, Physiotherapy and Diet control when used combindly and adopted as a way of life is safe and efficient in reducing pain, improving functional status. Previous studies also support our results (42, 43).

Recent evidence suggests that massage therapy may be helpful in the treatment of symptomatic Knee OA (44). The mechanisms of potential action of massage remain unclear, however, the proposed mechanisms include improving local blood flow, promoting venous circulation, increasing lymphatic drainage to remove waste products, improving the mobility of ligaments, tendons and muscle, as well as muscles relaxation (45).

Massage therapy may significantly reduce the symptoms and improve the course of OA by increasing local circulation to the affected joint, improving musculature tone, enhancing joint flexibility, and relieving pain (24). Massage therapy has been evaluated and found to be effective in reducing pain for various musculoskeletal conditions (25, 26). Studies support the effectiveness of massage in management of pain caused by musculoskeletal disorders (46, 47-51) including OA of the knee (52–54).

Similar findings were observed in the results of our study on OA knees. It is evident that massage as an adjunct therapy or alternative therapy is very effective for OA knees patients. Current modern medicine treatments available for OA are associated with high rates of adverse reaction due to their toxic effect in patients (55-60). Therefore, increasing trend has been observed that patients are giving preference to the massage therapy as an alternate treatment for OA of knees (61-64).

Massage not only enhances blood circulation, however, tone up the muscles while improving structural as well as functional status. It also helps in mobilizing fat and, therefore, reducing the weight. All the movements of massage make muscles and fat tissues more functioning and sensitive. Massage also generates heat with increased circulation in blood and bringing down all the impurities to the channel and recent studies support these effects (65-67).

Massage therapy's potential outcomes and effectiveness comprise decrease muscle strain, positive mechanical changes in muscles and balancing of muscle tension across the joints, increased joint flexibility, increased lymphatic circulation, changes in immunological and inflammatory markers, improvement in sleep and blocking of pain signals (68-73).

The study suggests that massage therapy is safe and effective for reducing pain and improving functions in patients with symptomatic OA of the knee.

The periodic application of superficial hot and cold compress is a relatively safe and low cost treatment that can be recommended separately or in combination with other treatments for patients with knee OA (74). Contrast therapy involving intervals of heat and cold application within a treatment session offers an additional option in the management of OA knees. Few studies are available suggesting greater benefits of superficial heat, cold, or contrast therapies (75). In previous study (76), significant pain reduction was observed after using hot and cold compress, which is similar to the results we have observed in the present study. It was also concluded that contrast therapy have wide effect on OA knees symptoms such as inflammation, decreased edema, pain and stiffness (77). Contrast therapy has shown improvement in pain and stiffness in OA knees patients after using Cold and Warm pack (78).

In the present study, a year long Yoga therapies brought significant improvement in functional status, pain and physical status in OA knees patients. Mind-body therapies may improve specific outcomes related to osteoarthritis of the knee, particularly pain and physical function. Yoga improves physical, mental, intellectual and spiritual health. It offers an effective method of managing and reducing stress, anxiety and depression. Numerous studies also demonstrate the efficacy of yoga on mood related disorders. One pilot study of OA of knees suggests significant reduction in pain, physical function, and improvement of symptoms with no adverse effect (27). In a comparative study, significant improvement was observed in all the variables among yoga group than the control group i.e. pain, joint tenderness, early morning stiffness, knee disability (79). Similarly, our study results have showed the positive effects of yoga in reducing symptoms of knee osteoarthritis.

Recent studies have shown yoga to enhance cardiopulmonary fitness (80), and improve balance in older population (28). Another study was conducted to evaluate the effects of yoga exercises on quality of life in patients with knee osteoarthritis. The results showed more improvement in quality of life in the experimental group (yoga and physical therapy) (81). Results of our study confirm the positive effects of yoga on improvement of quality of life in patients with knee osteoarthritis.

The efficacy of the integrated approach of yoga therapy in patients with chronic low back pain was observed and shown 48.8% reduction in Numerical Rating Scale scores in the Yoga group (82). The effect of Iyengar yoga in patients with OA hands showed a better reduction in the pain during activity (83). It was also cited in the previous study where reduction in pain and tenderness in patients with common neck pain after integrated yoga (84).

This case control study was conducted to observe the effect of Yoga, Naturopathy and Physiotherapy modalities with diet control as a package treatment for OA of elderly people. Our result shows significant improvement in pain, morning stiffness, SF-12, Vitamin D3 level, 50 foot walk test, MMT and ROM parameters in the intervention group, after taking one year of treatment as compared to baseline. However, significant difference was also observed in control group after taking one year of allopathic medicines. In group I, improvement in pain, morning stiffness, SF-12, and in Vitamin D3 was observed after one year of treatment as compared to baseline. The interesting findings we have observed in our study is that patients with OA knees who did not receive allopathic treatment for one year and were taking our package of Yoga, Naturopathy and Physiotherapy shows significant improvement in their physical and functional status.

A randomized control trial had shown pain reduction in physiotherapy group as well as placebo (only yoga) group after 24 weeks of intervention (85). These results differ to

ours which shows significant improvement in range of motion in intervention group as compared to control group (only allopathic). The discordant results between the two studies may be due to the intervention received in our study includes massage, yoga along with physiotherapy.

Another study shows improvement in pain and ROM parameters after using Isometric quadriceps after taking 14 days of treatment (86). Similarly, significant reduction in pain in the OA knees was observed after taking one month Interferential therapy (87).

The result from our study shows that Isometric and strengthening exercises are useful in the treatment of OA knees along with yoga and naturopathy intervention. There was a change in mean peak torques of knee flexion and extension in concentric and eccentric contraction in all group 2 patients who were on Physiotherapy treatment after taking a year long treatment as compared to baseline. In group I patients significant difference was observed in Right knee Hamstring, quadriceps (MMT), Right knee Flexion and Extension (ROM) after taking one year of allopathic treatment as compared to baseline. No significant difference was observed in MMT and ROM parameters in left knee hamstring, quadriceps, left knee flexion and extension in group I patients. These results are in agreement with the previous studies (88, 89).

Systematic reviews of conservative treatment have documented the effectiveness of exercise in reducing pain and disability due to knee OA. Evidence suggests that stretching and strengthening exercises decrease pain and improve muscular strength, functional ability and psychological well-being (90-93).

In our study 50 foot walk test was found to be associated with significant improvement in walking capacity with increased knee function. One previous study shows improvement in 50 foot walk test in terms of functional measure (94). Another study shows that proprioceptive exercises are superior to conventional treatment of osteoarthritis of knee in terms of increasing range of motion, decrease in pain VAS, decreasing disability WOMAC score (95). These findings indicate that modalities of Physiotherapy treatment to the muscles around the knee may be beneficial to maintain the knee joints.

Several studies have been separately focused on effect of Yoga or Naturopathy in the treatment of Osteoarthritis of Knees. However, till now no study has been done to evaluate the effect of yoga, naturopathy, physiotherapy along with diet control altogether as a package treatment for osteoarthritis of Knees. Therefore, it is felt to develop this package treatment for the benefit of elderly people more than 60 years of age who are suffering from Osteoarthritis of Knees to improve their health status as these modalities do not create any adverse effect, however, quite popular as no risk is associated with the treatment.

5. Conclusion

A combined package of Yoga, Naturopathy and Physiotherapy with diet control is efficacious in reducing pain, facilitates improvement in functional status, therefore, well accepted by the elderly people suffering from OA knees. Findings of this study suggest that combined package used is a safe, effective, and acceptable treatment for elderly people with OA knees.

It is a cost effective treatment without any adverse effect and can be used effectively as an adjunct therapy in treatment of Osteoarthritis of Knees. Future scope of Yoga, naturopathy and physiotherapy therapies with diet control as a package may offer the best hope of alleviating pain, improvement in functional status in OA knees.

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References

[1] Anderson J, Felson DT. Factors associated with osteoarthritis of the knee in the first National Health and Nutrition Examination survey. Am J Epidemiol 1988; 128:179-89.).
[2] Creamer P. and Hochberg MC, “Osteoarthritis,” *The Lancet*, vol. 350, no. 9076, pp. 503–508, 1997.
[3] Nuki G, “Osteoarthritis: a problem of joint failure,” *Zeitschrift fur Rheumatologie*, vol. 58, no. 3, pp. 142–147, 1999.
[4] Hunter DJ and Felson DT, “Osteoarthritis,” *British Medical Journal*, vol. 332, no. 7542, pp. 639–642, 2006.
[5] Bosomworth NJ. Exercise and knee osteoarthritis: benefit or hazard? *Can Fam Physician* 2009; 55: 871-878.
[6] Arden N, Nevitt MC. Osteoarthritis: epidemiology. Best Pract Res Clin Rheumatol. 2006; 20:3-25.
[7] Elders MJ. The increasing impact of arthritis on public health. J Rheumatol. 2000; 60 :6-8.
[8] Lawrence RC, Helmick CG, Arnett FC, et al. Estimates of the prevalence of arthritis and selected musculoskeletal disorders in the United States. Arthritis Rheum. 1998; 41:778-799.
[9] Felson DT. An update on the pathogenesis and epidemiology of osteoarthritis. Radiol Clin North Am. 2004; 42:1-9.
[10] Kaufman KR, Hughes C, Morrey BF, et al.: Gait characteristics of patients with knee osteoarthritis. J Biomech, 2001, 34: 907–915.
[11] Iorio R, Healy WL: Unicompartmental arthritis of the knee. J Bone Joint Surg Am, 2003, 85-A: 1351–1364.
[12] Sharma L, Pai YC, Holtkamp K, et al.: Is knee joint proprioception worse in the arthritic knee versus the unaffected knee in unilateral knee osteoarthritis? Arthritis Rheum, 1997, 40: 1518–1525.

[13] Slemenda C, Brandt KD, Heilman DK, et al.: Quadriceps weakness and osteoarthritis of the knee. Ann Intern Med, 1997, 127: 97–104.
[14] Fajardo M, Di Cesare PE. Disease-modifying therapies for osteoarthritis: current status. Drugs Aging. 2005; 22:141-161.
[15] Slemenda CW. The epidemiology of osteoarthritis of the knee. Curr Opin Rheumatol 1992; 4:546-51.
[16] Bitton R. The economic burden of osteoarthritis. Am J Manag Care 2009; 15(8:S230-S235).
[17] Caporali R, Cimmino MA, Sarzi-Puttini P et al. Comorbid conditions in the AMICA study patients: Effects on the quality of life and drug prescriptions by general practitioners and specialists. Semin Arthritis Rheum 2005; 35: 31-37.
[18] Rosemann T, Laux G, Szecsenyi J. Osteoarthritis: Quality of life, comorbidities, medication and health service utilization assessed in a large sample of primary care patients. J Orthop Surg 2007; 2:12-20.
[19] Moskowitz RW. The burden of osteoarthritis: Clinical and quality-of-life issues. Am J Manag Care 2009; 15(8):S223-S229.
[20] Hawker GA, French MR, Waugh EJ et al. The multidimensionality of sleep quality and its relationship to fatigue in older adults with painful osteoarthritis. Osteoarthritis Cartilage 2010; 18:1365-1371.
[21] Sturnieks DL, Tiedemann A, Chapman K et al. Physiological risk factors for falls in older people with lower limb arthritis. J Rheumatol 2004; 31:2272-2279.
[22] Hochberg MC. Mortality in osteoarthritis. Clin Exp Rheumatol 2008; 26 (5):S120-S124.
[23] Wiley-Exley EK, T. J. Mielenz, E. C. Norton, and L. F. Callahan, "Complementary and alternative medicine use in musculoskeletal disorders: does medical skepticism matter?"
[24] *Open Rheumatology Journal*, vol. 1, no. 1, pp. 5–11, 2007.
[25] Fitzcharles MA, D. Lussier, and Y. Shir, "Management of chronic arthritis pain in the elderly," *Drugs & Aging*, vol. 27, no. 6, pp. 471–490, 2010.
[26] Shin SY and Kolanowski AM, "Best evidence of psychosocially focused nonpharmacologic therapies for symptommanagement in older adults with osteoarthritis," *PainManagement Nursing*, vol. 11, no. 4, pp. 234–244, 2010.
[27] Hawker GA, S. Mian, K. Bednis, and I. Stanaitis, "Osteoarthritis year 2010 in review: non-pharmacologic therapy," *Osteoarthritis and Cartilage*, vol. 19, no. 4, pp. 366–374, 2011.
[28] Burks K, "Osteoarthritis in older adults: current treatments," *Journal of Gerontological Nursing*, vol. 31, no. 5, pp. 11–1960, 2005.
[29] Wang C, "Tai Chi and rheumatic diseases," *Rheumatic Disease Clinics of North America*, vol. 37, no. 1, pp. 19–32, 2011.
[30] Woolf A, Pfleger B. Burden of major musculoskeletal conditions. Bull World Health Organ 2003; 81(9):646e56.
[31] Bonadonna R. Meditation's impact on chronic illness. Holist Nurs Pract 2003;17(6):309–319.
[32] Astin JA, Shapiro SL, Eisenberg DM, Forys KL. Mind-body medicine: state of the science, implications for practice. J Am Board Fam Pract 2003;16(2):131–47.
[33] Garfinkel M, Schumacher HR: Yoga. Rheum Dis Clin N Am 2000; 26:125-132.
[34] Taylor MJ: Yoga therapeutics: an ancient, dynamic systems theory. Tech Orthop 2003; 18:115-125.
[35] Nayak S, Matheis RJ, Agostinelli S et al. The use of complementary and alternative therapies for chronic pain following spinal cord injury: a pilot survey. J Spinal Cord Med. 2001; 24:54-62.
[36] Ernst E. Complementary and alternative medicine for pain management in rheumatic disease. Curr Opin Rheumatol. 2002; 14:58-62.
[37] Preyde M. Effectiveness of massage therapy for subacute low-back pain: a randomized controlled trial. CMAJ. 2000; 162: 1815-1820.
[38] Bijlsma JW. Analgesia and the patient with osteoarthritis. Am J Ther 2002;9:189–197.
[39] Wegman A, van der Windt D, van Tulder M, et al. Nonsteroidal anti-inflammatory drugs or acetaminophen for osteoarthritis of the hip or knee? A systematic review of evidence and guidelines. J Rheumatol 2004; 31:344–354.
[40] Towheed TE, Maxwell L, Judd MG, et al. Acetaminophen for osteoarthritis. Cochrane Database Syst Rev 2006;1:CD004257.
[41] Bjordal JM, Ljunggren AE, Klovning A, Slordal L. Non-steroidal anti-inflammatory drugs, including cyclo-oxygenase-2 inhibitors, in osteoarthritic knee pain: Meta-analysis of randomised placebo controlled trials. BMJ 2004;329:1317.
[42] Seed SM, Dunican KC, Lynch AM. Osteoarthritis: A review of treatment options. Geriatrics 2009; 64:20–29.
[43] Kolasinski SL, Garfinkel M, Tsai AG, Matz W, Van Dyke A, Schumacher HR. Iyengar yoga for treating symptoms of osteoarthritis of the knees: A pilot study. J Altern Complement Med. 2005; 11:689-93.
[44] Ranjita R. Swami Vivekananda Yoga Anusandhana Samsthana, Bengaluru.Karnataka: 2008. Effect of yoga on pain, mobility, gait, and balance in patients with osteoarthritis of the knee.
[45] Yuan W , Bannuru RR, Kong L, Cheng Y, McAlindon T, Fang M et al. A MASSAGE THERAPY ON PAIN RELIEF FOR KNEE OSTEOARTHRITIS;: A SYSTEMATIC REVIEW AND META-ANALYSIS. Osteoarthritis and Cartilage 20 (2012) S54–S296.
[46] Goats GC, "Massage - The scientific basis of an ancient art. Part 2. Physiological and therapeutic effects," British Journal of Sports Medicine, vol. 28, no. 3, pp. 153–156, 1994.
[47] Ezzo J, Haraldsson BG, Gross AR et al. "Massage for mechanical neck disorders: a systematic review," *Spine*, vol. 32, no. 3, pp. 353–362, 2007
[48] Frey Law LA, Evans S, Knudtson, Nus JS, Scholl K, Sluka KA et al. "Massage reduces pain perception and hyperalgesia in experimental muscle pain: a randomized, controlled trial," *Journal of Pain*, vol. 9, no. 8, pp. 714–721, 2008.
[49] Sherman KJ, Cherkin DC, Hawkes RJ, Miglioretti DL, Deyo RA, "Randomized trial of therapeutic massage for chronic neck pain," *The Clinical Journal of Pain 2009*, 25, 3, 233–238.

[50] Hernandez-Reif M, Field T, Krasnegor J, Theakston H. "Lower back pain is reduced and range ofmotion increased after massage therapy," *International Journal of Neuroscience 2011*, 106, 3-4, 131–145.
[51] Cherkin DC, Sherman KJ, Deyo RA, Shekelle PG. "A review of the evidence for the effectiveness, safety, and cost of acupuncture, massage therapy, and spinal manipulation for back pain," *Annals of InternalMedicine 2003*, 138;11, 898– 906.
[52] Preyde M. "Effectiveness of massage therapy for subacute lowback pain: a randomized controlled trial," *Canadian Medical Association Journa 2000*, 162; 13, 1815–1820.
[53] Klinsrisuk S, Eungpinichpong W, Sumanont S, Chatchawan U. "The effect of modifiedThai therapeutic massage on pain reduction and knee function in individuals with primary knee osteoarthritis: a randomized control trial," *Journal of Medical Technology and Physical Therapy 2007*,. 9, 3; 248–260.
[54] Perlman AI, Sabina A, Williams A, Njike VY, Katz DL. "Massage therapy for osteoarthritis of the knee: a randomized controlled trial," *Archives of Internal Medicine 2006*, 166, 22; 2533–2538.
[55] Atkins DV and Eichler DA."The effects of self-massage on osteoarthritis of the knee: a randomized, controlled trial," *International Journal of Therapeutic Massage and Bodywork* 2013, 6; 1, 4–14.
[56] Felson DT, Lawrence RC, Hochberg MC, et al. Osteoarthritis: new insights, II: treatment approaches. *Ann Intern Med*. 2000; 133:726-737.
[57] Naesdal J, Brown K. NSAID-associated adverse effects and acid control aids to prevent them: a review of current treatment options. *Drug Saf*. 2006; 29:119-132.
[58] Hogenmiller MS, Lozada CJ. An update on osteoarthritis therapeutics. *Curr Opin Rheumatol*. 2006; 18:256-260.
[59] Hogue JH, Mersfelder TL. Pathophysiology and first-line treatment of osteoarthritis. *Ann Pharmacother*. 2002;36:679-686.
[60] Malonne H, Coffiner M, Sonet B, Sereno A, Vanderbist F. Efficacy and tolerability of sustained-release tramadol in the treatment of symptomatic osteoarthritis of the hip or knee: a multicenter, randomized, double-blind, placebo-controlled study. *Clin Ther*. 2004; 26:1774-1782.
[61] Perneger TV, Whelton PK, Klag MJ. Risk of kidney failure associated with the use of acetaminophen, aspirin, and nonsteroidal antiinflammatory drugs. *N Engl J Med*. 1994;331:1675-1679.
[62] Ernst E. Musculoskeletal conditions and complementary/alternative medicine. *Best Pract Res Clin Rheumatol*. 2004; 18:539-556.
[63] Nayak S, Matheis RJ, Schoenberger NE, Shiflett SC. Use of unconventional therapies by individuals with multiple sclerosis. *Clin Rehabil*. 2003; 17:181-191.
[64] Ramsey SD, Spencer AC, Topolski TD et al. Use of alternative therapies by older adults with osteoarthritis. *Arthritis Rheum*. 2001; 45: 222-227.
[65] Setty AR, Sigal LH. Herbal medications commonly used in the practice of rheumatology: mechanisms of action, efficacy, and side effects. *Semin Arthritis Rheum*. 2005; 34:773-784.
[66] Kirby BS, Carlson RE, Markwald RR, Voyles WF, Dinenno FA (2007) Mechanical influences on skeletal muscle vascular tone in humans: insight into contraction-induced rapid vasodilatation. J Physiol 583: 861–874.
[67] Sefton JM, Yarar C, Berry JW, Pascoe DD (2010) Therapeutic massage of the neck and shoulders produces changes in peripheral blood flow when assessed with dynamic infrared thermography. J Altern Complement Med 16: 723–732.
[68] Cambron JA, Dexheimer J, Coe P, Swenson R (2007) Side-effects of massage therapy: a cross-sectional study of 100 clients. Journal of Alternative & Complementary Medicine 13: 793–796.
[69] Billhult A, Lindholm C, Gunnarsson R, Stener-Victorin E, Gunnarsson R (2009) The effect of massage on immune function and stress in women with breast cancer–a randomized controlled trial. Autonomic Neuroscience-Basic & Clinical 150: 111-115.
[70] Poole A, Ionescu M, Fitzcharles M, Billinghurst R (2004) The assesment of cartilage degradation in vivo: development of and immunoassay for the measurement in body fluids of type II collagen cleaved by collagenases. J Immunol Methods 294: 145–153.
[71] Schaible H-G, Grubb B (1993) Afferent and spinal mechanisms of joint pain. Pain 55: 5–54.
[72] Ahles TA, Tope DM, Pinkson B, Walch S, Hann D, et al. (1999) Massage therapy for patients undergoing autologous bone marrow transplantation. Journal of Pain and Symptom Management 18: 157.
[73] Diego M, Field T, Hernandez-Reif M, Shaw K, Friedman L, et al. HIV adolescents show improved immune function following massage therapy. International Journal of Neuroscience 2001; 106: 35.
[74] Sagar SM, Dryden T, Myers C. Research on therapeutic massage for cancer patients: potential biologic mechanisms. Journal Of The Society For Integrative Oncology 2007; 5: 155–162.
[75] Oosterveid FG, Rasker JJ. Treating arthritis with locally applied heat or cold. Semin Arthritis Rheum. 1994;24(2):82–90.
[76] Brosseau L, Yonge KA, Robinson V, et al. Thermotherapy for treatment of osteoarthritis. Cochrane Database Syst Rev. 2003;(4): CDO04522
[77] Denegar CR, Dougherty DR, Friedman JE et al. Preferences for heat, cold or contrast in patients with knee osteoarthritis affect treatment response. Clin Interv Aging 2010; 5, 199-206.
[78] Bonham S, Gall T, Werder Y, Petersen W. The effect of a contrst therapy recovery technique on the post one hour performance of netball players. University of Otago, Dunedin.
[79] Shehata AE, Fareed ME. Effect of cold, warm or contrast therapy on controlling knee osteoarthritis associated problems. International Journal of Medical, Health, Biomedical and Pharmaceutical Engineering 2013; 7 (9), 204-210.
[80] John Ebnezar and Bali Yogitha. Effectiveness of Yoga Therapy with the Therapeutic Exercises on Walking Pain, Tenderness, Early Morning Stiffness and

Disability in Osteoarthritis of the Knee Joint - A Comparative Study. Journal of Yoga and Physical Therapy. 2012.
[81] Raub JA. Psychophysiologic effects of Hatha Yoga on musculoskeletal and cardiopulmonary function: a literature review. J Altern Complement Med 2002; 8(6):797–812.
[82] Ebnezar J, Nagarathna R, Bali Y, Negendra HR. Effect of integrated approach of yoga therapy on quality of life in osteoarthritis of the knee joint: A randomized control study. Int J Yoga. 2011; 4:55–63.
[83] Tekur P, Singhpow C, Nagarathna HR, Raghuram N. Effect of short term intensive yoga program on pain, functional disability, and spinal flexibility in chronic low back pain: A randomized control study. J Altern and Complement Med.2008; 14:637-44.
[84] Garfinkel MS, Schumacher R, Husain A, Levy M, Reshetar RA. Evaluation of a yoga based regimen for treatment of osteoarthritis of the hands. J Rheumatol.1994; 21:2341–3
[85] Yogitha B, Nagarathna R, John E, Nagendra H. Complimentary effect of yogic sound resonance relaxation technique in patients with common neck pain. Int J Yoga.2010; 3:18-25.
[86] Bennell KL, Hinman RS, Metcalf BR, Buchbinder R, McConnell J, McColl G et al. Efficacy of physiotherapy management of knee joint osteoarthritis: a randomised, double blind, placebo controlled trial. Ann Rheum Dis 2005; 64: 906-912.
[87] Adegoke BO, Mordi EL, Akinpelu OA, et al.: Isotonic quadriceps-hamstring strength ratios of patients with knee osteoarthritis and apparently healthy controls. Afr J Biomed Res, 2007, 10: 211–216.
[88] Emrani A, Bagheri H, Hadian MR, et al.: Isiokentic strength and functional states in knee osteoarthritis. J Phys Ther Sci, 2006, 18: 107–114.
[89] 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, 1181–1187.
[90] Duncan A Reid and Peter J McNair. "Effects of a six week lower limb stretching programme on range of motion, peak passive torque and stiffness in people with and without osteoarthritis of the knee" NEW ZEALAND JOURNAL OF PHYSIOTHERAPY , 39(1), 2-9.
[91] Vignon E, Valat JP, Rossignol M, et al.: Osteoarthritis of the knee and hip and activity: a systematic international review and synthesis (OASIS). Joint Bone Spine, 2006, 73: 442–455.
[92] Van Baar ME, Assendelft WJ, Dekker J, et al.: The effectiveness of exercise therapy in patients with osteoarthritis of the hip or knee: a systematic review of randomized clinical trial. Arthritis Rheum, 1999, 42: 1361–1369.
[93] Fransen M, McConnell S, Bell M: Exercise for osteoarthritis of the hip or knee. Cochrane Database Syst Rev, 2003, 3: CD004286.
[94] Hendry M, Williams NH, Markland D, et al.: Why should we exercise when our knees hurt? A qualitative study of primary care patients with osteoarthritis of the knee. Fam Pract, 2006, 23: 558–567.
[95] Kulig K, Beneck GJ, Selkowitz DM, Popovich JM. "An Intensive, Progressive Exercise Program Reduces Disability and Improves Functional Performance in Patients After Single-Level Lumbar Microdiskectomy" 2011, 89; 11.
[96] Mondam S., Srikanth Babu V., Raviendra Kumar B., Prakash J. "A Comparative Study of Proprioceptive Exercises versus Conventional Training Program on Osteoarthritis of Knee" :Research Journal of Recent Sciences, 2012, 1(12), 31-35.

Author Profile

Dr. Rukamani Nair is Medical Superintendent of Bapu Nature Cure Hospital and Yogashram. She is a Naturopathy Doctor from Osmania University and Principal Investigator in this DST funded project of Osteoarthritis of Knees.

Dr. Gaurav Kaushik is PhD in Life Science from All India Institute of Medical Sciences (AIIMS), New Delhi. He is presently working as a Research Coordinator in Science, Research and Innovation Division of Bapu Nature Cure Hospital and Yogashram, Delhi.

Dr V. N. Gaur is a Orthopaedic Doctor (MBBS, MD) in a private Hospital and Co-PI in this DST project of Osteoarthritis of Knees.

Dr. Ravi Pratap Singh is a physiotherapist (BPT), presently working at Science, Research and Innovation Division of Bapu Nature Cure Hospital and Yogashram, Delhi.