



Role of selective yoga postures and rope & belt therapy in conservative care of osteoarthritis of knee joint- A non-randomized control trial

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Abstract

Introduction: OA knee is most common clinical condition. Most common form of its treatment being Physiotherapy, use of NSAIDs or surgery in severe cases, to reduce pain, stiffness and improve movement. Selective Yoga postures and Rope & Belt Therapy can also be of use in conservative care of OA knee patients because of their scientific basis.

Aim: To study the effect of selective yoga postures and Rope & belt therapy (RBT) in conservative care of OA Knee patients.

Method: 120 participants were divided in two groups of 60 each. Study group was given intervention of Yoga and RBT for 4 wks. Control group was not given any intervention but they were taking pharmacological treatment as prescribed by their Orthopedician.

Results: 4 wks of selective yoga postures and Rope & belt therapy significantly reduced Pain, Stiffness and improved mobility in OA knee patients ($P < 0.001$)

Conclusion: Yoga and Rope & belt therapy could open up new avenues for developing standards for best clinical practices for this patient population.

Keywords: OA knee, RBT, yoga, pain, stiffness, mobility

Introduction

Knee joint is most mobile, weight bearing but incongruous joint. Hence degenerative changes occurring in its medial tibio-femoral and patello-femoral compartments are very common. These occur due to disequilibrium of mechanical strength of articular cartilage and mechanical stress imposed upon it^[1]. These changes lead to Osteoarthritis (OA) of knee joint. Age is the most powerful risk factor for OA knee. In radiographic survey 2% of women of less than 45 yrs of age, 30 % between 45 to 64 yrs and 68% of more than 65 yrs had OA Knee^[2]. These changes are further enhanced by improper posture, lack of exercise and varus deformity. In some cases, it occurs due to excessive use like running, climbing etc.

Osteoarthritis of knee joint gives rise to symptoms like pain, stiffness and restriction of movements. Our medical approach to handle the cases of OA, is use of NSAIDs, Calcium with active form of Vit D and Physiotherapy. In spite of this, patient's condition slowly deteriorates leading to severe (grade IV) OA. The need of everyday analgesics makes a patient to take a decision of Total Knee Replacement (TKR).

However considering India's vast population and as majority of it belongs to low economic strata, the need is felt to think over low priced, easy to administer, effective, non invasive, non pharmacological way to handle these cases. Aim being minimizing pain, stiffness and improvement in knee movements. Patient's day to day life should be made comfortable. Role of selective Yoga postures and Rope & Belt therapy (RBT) is found to be meeting this requirement.

Selective Yoga postures aim at stretching of one group of muscles leading to reduction in stiffness and strengthening of other group of muscles which corrects upright posture leading to correction of Mechanical axis (weight bearing) of

body^[3]. Selective Yoga postures are taught to patients, which are to be practiced everyday for lifelong period.

Role of Rope & Belt Therapy^[5] lies 1) In correction of alignment of Anatomical axis of femur & tibia 2) Correction of Talus as Key-stone position of plantar arches 3) Correction of Plantar Arches .

Rope & Belt Therapy is given by trained Yoga therapist at the well equipped Yoga centre for a period of 1 to 3 months which leads to above mentioned corrections.

Technique of applying Ambulatory belts are taught to patients, which are advised for initial 3 to 6 months for continued correction.

This approach of selective Yoga postures and Rope & Belt Therapy has an immense potential for palliation and restoration for Osteoarthritis of Knee joint cases en mass. To the best of our knowledge there are no studies on effect of both, Yoga and Rope & Belt Therapy on Osteoarthritis of knee joint.

With this background we decided to undertake this project with following aim and objectives.

Aim: To study the effect of selective yoga postures and Rope & Belt Therapy in conservative care for Osteoarthritis of Knee Joint patients

Objective

1. To assess and compare pain, stiffness and movements of knee joint in study group (undergoing Yoga, rope & belt therapy) at baseline and after 4 wks of Yoga and Rope & Belt therapy
2. To assess and compare pain, stiffness and movements of knee joint in control group (on pharmacological treatment but not undergoing Yoga and rope & belt therapy) at baseline and after 4 wks.

- To assess and compare the changes occurring in pain, stiffness & movements of knee joint in study group and control group after 4 wks

Material and methods

Type of study: Non Randomized Control Trial.

Study group: Newly Diagnosed cases of OA knee (by Orthopedician on basis of X ray), having age between 40 to 75 years and undergoing Yoga and RBT intervention.

Control group: Age matched newly diagnosed patients of OA knee from orthopedic clinic without yoga and RBT intervention.

Sample size: Group I = 60, Group II = 60.

Inclusion criteria

- Age group 40 to 75 years.
- OA cases willing to minimize analgesics and willing to perform Yoga and RBT therapy.

Exclusion criteria

- Cases of arthritis of knee other than OA.
- Cases of OA Knee with swelling.
- Subjects who do not like to do exercise of any type.

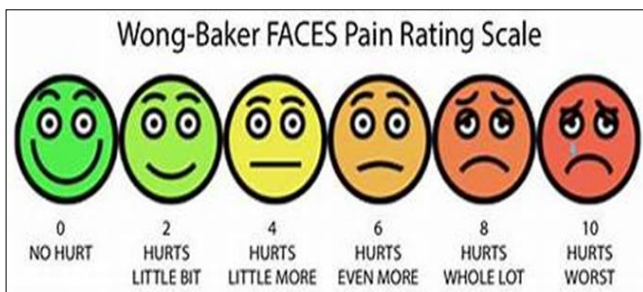
Methodology

A. Methodology for measurement of anthropometry

- Age – in years.
- Weight in kilograms.
- Height in meters.
- BMI=Wt/Ht in meter ^[2].

B. Methodology adopted for assessment of pain, stiffness and mobility

- Pain assessment chart- FPRS- faces pain rating scale score ^[4].
 - WOMAC Index ^[6].
- Pain assessment is done by using faces pain rating scale (FPRS) - '0' is no pain and '10' is extreme severe pain. Presence of 'faces' makes it easy and interesting to quantify pain.



- WOMAC Index ^[6] - is Western Ontario and Master University Osteo-arthritis index. It consists of 5 questions for pain, 2 for stiffness and 17 for day to day movements. Test questions are scored on a scale of 0 to 4 which correspond to none (0), mild (1), moderate (2), severe (3) and extreme (4). WOMAC total score is out of 96. Higher score indicates worse pain, stiffness and functional limitations.

C. Intervention by selective Yoga postures and RBT therapy

- In this study radio logically diagnosed cases (by Orthopedician) of mild, moderate, severe osteo-arthritis of knee who are fulfilling inclusion criteria and are willing to participate in the study will be included.
- X ray both knees AP (standing) & lateral is advised for diagnosis ^[7].

AP view shows

- Medial compartment narrowing (mild/moderate/severe)
- Irregular margins
- Presence of osteophytes
- Subluxation of tibia over femur in severe cases
- Lateral tilt of patella

Lateral view shows

- Reduction in patella femoral space
- Irregular margins
- Presence of osteophytes

- Study group subjects were taught selective yoga postures in 2 phases. Phase one was for stretching of one group of muscle and phase two was for strengthening of other set of muscles.
- They were given rope and belt therapy at yoga therapy centre by trained and experienced yoga therapist. They were also taught use of ambulatory belts and advised to use them in day to day life. (see details below)
- They were asked to take Tab Dolonex (Piroxicam) 20 mg DT, only if required.
- Study was conducted at 'Unnati Yogotherapy and Training Centre' Shivajinagar, Pune.
- Duration of therapy was for 75 to 90 min / day for 6 days a
- Wk for 4 wks.
- Cases of early and mild OA continued to practice Yoga postures at home and used the ambulatory belts.
- Cases of moderate and severe OA continued the therapy for 2 and 3 months respectively at 'Unnati Yoga Therapy and Training Centre'
- Control group did not participate in Yoga and RBT programme. They were taking analgesics as prescribed by their Orthopaedician.
- All subjects were assessed by FPRS and WOMAC Index at Baseline and at the end of 4 wks.
- All the test parameters and yogic exercises are non invasive and harmless for the patients. Yet a written informed consent was taken from all subjects participating voluntarily in the study.
- The study was approved by Institutional Ethics Committee of B J Govt Medical College, Pune.

- Ambulatory belts:** are the belts which are to be used by patients in day to day life. They are three in number

- Knee mobiliser:** It consists of two green belts .One is tied three fingers above the superior patellar border. It is positioned in such a way that the two ends are copulated at inner margin of thigh (Adductor tubercle is the anatomical landmark) to turn the lower end of thigh outwards (laterally) This belt counteracts the excessive medial rotation of lower end of femur by Adductor Magnus .Second belt is tied at upper end of leg, three fingers below the inferior margin of patella .It is

positioned in such a way that the two ends copulate at outer margin of leg (Head of the Fibula is the anatomical landmark) to turn the upper end of leg inward (medially). This belt counteracts the excessive lateral rotation of Fibula & Tibia by Biceps Femoris. This counteraction at lower end of Femur & upper end of Tibia helps to improve alignment of Femur & Tibia. This helps in smooth movement of Patella during alternate flexion & extension during walking. This also helps in smooth locking & unlocking movement of knee joint. Patients are taught to tie those belts & are advised to tie them on their body for three hours at a time, three times a day. Knee mobiliser is mainly used during walking.

2. Knee stabiliser: This belt is positioned at same points as in Knee mobiliser, but it is one long belt doing both functions (Inward turning of upper end of leg & outward turning of lower end of thigh) Its main significant action is, it supports the knee joint from behind by forming a cross. It is indicated in prolonged standing position as required in certain occupations like nursing, teaching, security guards etc.
3. Calf stretch: It is tied at upper end of leg, three fingers below inferior patellar margin while rotating the upper end of leg inwards medially. Its long end passes from great toe to little toe. With a wrap at mid foot (Transverse arch) it is fixed with its other end. It shows following effects - a) Reduction in Varus deformity b) Depression of elevated Medial longitudinal arch, Promotion of eversion, 90 degree dorsiflexion at knee joint & stretching of calf muscles. This is advised to be used at bedtime for 2/3 hours. It can be used while walking at home too.

▪ **Rope and Belt Therapy**



Fig 1: Double Knot Foot Stretch: Help in restoration of Plantar Arches



Fig 2: Double Knot Ankle Stretch- Helps to keep Talus at it's keystone position



Fig 3: Simple and fortified Varus Correction- Helps to correct Varus deformity



Fig 4: Vertical Leg Stretch- Helps in distraction between Femur & Tibia

Observations and Results

Statistical Analysis

Data were analyzed using descriptive and analytical tests by SPSS software.

The numerical variables are described by mean and standard deviation. A paired-t-test is performed to investigate the efficacy of treatment in both the groups. Concerning the primary outcome, the comparison between two groups is analyzed by test for equality of means (Z-test). A two sided p-value of less than 0.05 is considered as statistically significant

Table 1

	Total recruited	Attended up to 1st Follow up	Males	Females
Control Group	93	51	12	39
Trial Group	60	44	10	34

Initially, one hundred and fifty-three patients were included in this study. Of them, fifty-eight patients (control-42, trial-16) lost their 1st month follow up and were excluded from the study. Therefore, ninety-five patients (control-51, trial-44) completed the study. Both groups were well-matched for baseline and demographic characteristics (Table 1).

Table 2

Variable	Control Group (mean ± SD)	Trial Group (mean ± SD)
Age	57.65 ± 9.92	58.84 ± 9.76
Sex- number (%)	Male-12 (23.5%)	Male- 10 (22.7 %)
	Female-39 (76.5%)	Female- 34 (77.3%)
BMI	26.94 ± 3.59	27.68 ± 4.63

Table 3: Facial Pain Rating Score (FPRS) of Control and Study group at baseline and after 4 wks

FPRS Parameters	(Mean ± SD)	T	p-Value
Control Group (n=51)			
At baseline	7.33±1.37	20.074	0.0001*
After 4 wks	3.22±1.49		
Study Group (n=44)			
At Baseline	6.91 ± 2.09	10.267	<0.001*
After 4 wks	4.09 ± 2.07		

*Significant (p < 0.05) (FPRS- Faces Pain Rating scale)

Table 4: Pain, stiffness and movement using WOMAC Score amongst Control group at baseline and after 4 wks

WOMAC Parameters	Control Group (Mean ± SD)	t	p-Value
▪ Pain			
baseline	13.27 ± 5.27	13.996	<0.001*
After 4 wks	5.43 ± 3.83		
▪ Stiffness			
At baseline	4.65 ± 1.69	12.877	<0.001*
After 4 wks	1.78 ± 1.39		
▪ Movement			
At baseline	31.18 ± 12.52	13.772	<0.001*
After 4 wks	14.06 ± 9.40		
▪ Total score			
Pre	49.10 ± 18.15	15.564	<0.001*
Post	21.25 ± 13.51		

*Significant (p < 0.05) (WOMAC-Western Ontario and McMaster Universities Arthritis Index)

Table 5: Pain, stiffness using WOMAC Score amongst Study group at baseline and after 4 wks

WOMAC Parameters	Trial Group (Mean ± SD)	t	p-Value
▪ Pain			
At baseline	14.95 ± 5.82	9.374	<0.001*
After 4 wks	10.16 ± 5.21		
▪ Stiffness			
At baseline	3.75 ± 2.35	5.272	<0.001*
After 4 wks	2.64 ± 2.26		
▪ Movement			
At baseline	36.55 ± 15.18	7.832	<0.001*
After 4 wks	23.52 ± 13.10		
▪ Total			
Pre	55.25 ± 21.95	8.790	<0.001*
Post	36.32 ± 19.77		

*Significant (p < 0.05)

Table 6: Comparison of pain, stiffness and movement after first month between control and study group participants

WOMAC Parameters	(Mean ± SD)	t	p-Value
▪ Pain			
Control group	5.43 ± 3.83	-4.97	<0.001*
Study group	10.16 ± 5.21		
▪ Stiffness			
Control group	1.78 ± 1.39	-4.86	<0.001*
Study group	2.64 ± 2.26		
▪ Movement			
Control group	14.06 ± 9.40	-3.99	<0.001*
Study group	23.52 ± 13.10		
▪ Total			
Control	21.25 ± 13.51	-4.27	<0.001*
Trial	36.32 ± 19.77		

*Significant (p < 0.05)

Discussion

The present study was performed to investigate the effect of Yoga and Rope & belt therapy on mild to severe knee osteoarthritis symptoms. Control group subjects did not receive any yoga and RBT intervention and were taking pharmacological treatment as prescribed by their orthopedician. All parameters were recorded at baseline and after 4 wks of pharmacological treatment. Study group subjects received yoga and RBT intervention and all parameters were recorded at baseline and after 4 wks of intervention.

As shown in Table No 1, participants in study and control group were matched for age and BMI.

Table 2 shows the intensity of pain in knee joint as perceived by using Facial Pain Rating Scale. In control group Mean+SD at baseline was 7.33+1.37 and after 4 wks it was 3.22+1.49. P value is 0.0001 which is highly significant. For study group, values were 6.91+2.09 and 4.09+2.07 at baseline and after 4 wks of intervention respectively. P< 0.001 which is highly significant. This indicates that in both the groups the pain in knee joint was reduced significantly after 4 wks.

Table 3 shows scores of Pain, stiffness and movement using WOMAC Questionnaire amongst Control group at baseline and after 4 wks. There is highly significant reduction in pain (score at baseline 13.27 ± 5.27 to 5.43 ± 3.83 after 4 wks), stiffness (score at baseline 4.65 ± 1.69 to 1.78 ± 1.39 after 4 wks) and highly significant improvement in movement (score at baseline 31.18 ± 12.52 to 14.06 ± 9.40 after 4 wks) after 4 wks. As compared to baseline. Total WOMAC score reduced from 49.10+18.15 at baseline to 21.25 +- 13.51 after 4 wks which is also highly significant.

Table 4 shows scores of Pain, stiffness and movement using WOMAC Questionnaire amongst study group at baseline and after 4 wks. There is highly significant reduction in pain (score at baseline 14.95 ± 5.82 to 10.16 ± 5.21 after 4 wks), stiffness (score at baseline 3.75+2.35 to 2.64+-2.26 after 4 wks) and highly significant improvement in movement (score at baseline 36.55+-15.18 to 23.52+-13.10 after 4 wks) after 4 wks. As compared to baseline. Total WOMAC score reduced from 55.25+-21.95 at baseline to 36.32+-19.77 after 4 wks Of Yoga and RBT intervention which is also highly significant.

Table 5 shows Comparison of pain, stiffness and movement after first month between control and study group participants. There is highly significant reduction in pain (5.43+-3.83 & 10.16+- 5.21), stiffness (1.78+-1.39 & 2.64+- 2.26) and highly significant improvement in movement (14.06+- 9.40 & 22.52+- 13.10) in control group as compared to study group after 4 wks. There was also highly significant reduction in total WOMAC score (21.25+- 13.51 & 36.32+- 19.77) in control group as compared to study group after 4 wks.

In our study, both the control and study groups showed statistically significant differences as regards the degree of reduction in the WOMAC total score and the WOMAC subscale scores of pain, stiffness and function over time (at one-month follow-up).

When control and study groups were compared at the end of 1 mt Total WOMAC score and WOMAC subscale scores reported a rapid reduction in control group as they experience immediate relief from pain, stiffness after taking pharmacological treatment,

On the other hand, for those in the study group reduction in pain, stiffness and functional improvement occurred gradually from baseline through the first month of follow-up. Additionally, despite the fact that the results showed a greater degree of reduction in the WOMAC total and subscale scores in control group (on pharmacologic treatment) than in the study group, it is important to acknowledge the significant reduction in pain, stiffness and functional improvement in study group at baseline and after 4 wks of Yoga and RBT intervention.

Gholam a Ghasemi, *et al.* [8] found that 8 wks of Hata Yoga significantly reduced pain and symptoms of OA knee in women.

John Ebnezar, *et al.* [9]. evaluated efficacy of additional integrated yoga therapy to therapeutic exercises in 60 OA Knee patients and found that integrated approach of yoga therapy improves knee disability and quality of life in OA knee patients.

Singh Deepeshwar *et al.* [10], in their study on 31 participants who received integrated approach of yoga therapy (AYT) and 35 control group without AYT intervention found that AYT practice improved muscle strength, flexibility and functional mobility.

V Awasthi, *et al.* [11] did study in 30 OA Knee patients. Group A was given Yoga with conventional clinical treatment including physiotherapy and gr B was given conventional treatment only. Clinical outcomes were assessed by WOMAC score before and 3 mts after treatment and found that severity of pain and stiffness significantly reduced in Gr A patients as compared to patients in Gr B.

To the best of our knowledge there are no studies to evaluate the effect of Rope and Belt Therapy on OA Knee. Our study evaluated the effect of both Yoga and RBT in OA Knee patients

Selective Yoga postures cause stretching of one group of muscles leading to reduction in stiffness and strengthening of other group of muscles which corrects upright posture leading to correction of mechanical axis of body.³ Rope and belt therapy helps in correction of planter arches, proper positioning of Talus at planter arches, alignment of femur and tibia and correction of lateral tilt of patella, as mentioned in detail above.

Yoga and Rope & belt therapy generates favorable outcomes, reduces pain and stiffness and improves the performance status of patients with knee osteoarthritis. Patients are willing to take this conservative therapy because they want to avoid adverse reactions of analgesic drugs.

Conclusion

The findings of this study could open up new avenues for developing standards for best clinical practices for this patient population. Improving the awareness and ability of patients seems crucial for improving their health status. As a result, we can conclude that Yoga and rope & belt training can assist OA knee patients in undertaking self-care measures and improving their health condition by avoiding side effects of pharmacological treatment.

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Conflict of interest: Authors declare no conflict of interest.

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