Original Article

Comparative study of role of physiotherapy alone versus physiotherapy combined with yoga in rehabilitation after a sports injury. What can a primary physician offer?

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Abstract

Background: Posttraumatic rehabilitation of sports injuries involves physiotherapy. Additionally, nonsurgical treatment of sports injuries involves regular physiotherapy as a major treatment therapy. This study aimed to evaluate the effects of yoga in addition to regular physiotherapy on these patients. **Materials and Methods:** In the present comparative study, we evaluated the effects of regular physiotherapy alone versus physiotherapy combined with yoga on 212 patients following various knee injuries treated nonsurgically. The study was conducted after obtaining hospital ethical, committee clearance, and written informed consent from patients. The patients were assigned into two groups: group C (Conventional) and group Y (Yoga group). The patients in the regular group received physiotherapy rehabilitation program, whereas the yoga group received additional yoga once every day by a yoga expert during their hospital stay. We provided written guidelines and photographs of the yoga asanas and instructed to perform them 3 days/week once they were home. The data on WOMAC score were collected at 6 weeks, 3 months, and at 6 months from the day of discharge from the hospital. **Results:** We noted that the yoga group patients showed a significant improvement ($P < 0.05$) in all modalities like pain, stiffness, and function subscales of the WOMAC scale. They experienced significant reduction in pain and stiffness compared with the regular or conventional group on the seventh postinjury day, 6 weeks, 3 months, and 6 months after the initial injury. **Conclusion:** In this study, a combination of regular physiotherapy and yoga provided better functional outcomes than physiotherapy alone.

Keywords: Nonsurgical treatment, physiotherapy, sports injuries, yoga

Introduction

Sports related injuries are common injuries that constitute major joint and ligament dysfunction worldwide. Since the sports industry is very competitive and lucrative for sportspersons along with high intensity of physical and emotional involvement of players, there has lately been an increase in sports related injuries.[1-3] This intensified the physical and emotional aspects and burden of sports and its related injuries. In modern competitive sport, injured sportspersons are under constant pressure to return to their games as early as possible. Hence, compared to traditional rehabilitation after injury, sports injuries' rehabilitation requires more care. Therefore, a highly structured sports-specific approach should be adopted for athletes and injured tissues according to the physical and psychological demands at the highest level of sport. The growing popularity of various sports

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like football, hockey, badminton, and kabaddi leagues in India is evidence of a growing sports culture in our country apart from the predominantly favored cricket. The awareness regarding the role of yoga in sports related injuries among primary physicians will help in treatment and rehabilitation of those patients who cannot afford costly physiotherapy, especially in rural setups.

This study attempts to evaluate the outcome of rehabilitation using regular or conventional physiotherapy versus physiotherapy combined with yoga in various sports injuries treated nonsurgically.

Injuries in any sports can occur through various mechanisms and may constitute acute or overuse injuries.[4] Sports injuries may involve ligaments, muscle, and fractures. Musculoskeletal injuries are the commonest injuries in sports and comprises 80% of all injuries.[5,6] Joint injuries, especially of the knee, is the commonest of injuries in all sportsmen. Not only the knee but also elbow, hip, and back can get injured depending on the mechanism of injury. These injuries require operative and nonoperative management followed by a long rehabilitation period, as documented by Kujala *et al*.[7] Musculoskeletal flexibility, stability, muscle strength, and balance can be increased through yoga and physical therapy. These activities bring improvement in injured sportspersons and subsequently increase perception regarding usefulness of the therapeutic yoga and physical therapy. Brewer *et al*.[8] described a biopsychosocial model that helps to understand rehabilitation following a sport injury. He also explained that physiotherapy and yoga, when combined in rehabilitation, could improve the psychological and biological factors that have a positive and significant effect on the biopsychological outcomes. However, both authors, Whiting[9] and Ravi,[10] have also reported a favorable outcome following inclusion of yoga in rehabilitation program. In our study, we explore the usefulness of yoga in sport injury rehabilitation. Combined efforts of yoga therapists, physiotherapists, sport medicine experts, and trainers might help sportspersons to enhance adherence to sport injury rehabilitation programs.

In spite of the high frequency and morbidity following injuries in sportspersons, there are no studies from India focusing on the outcome of these injuries using yoga along with physiotherapy.

Material and Methods

We included 212 patients with various sports injuries treated in nonsurgical ways in a prospective cohort study. The present study was conducted between April 2018 and July 2021. Approval was obtained from the hospital ethical committee, where the study was conducted.

Inclusion criteria

(a) Age: 15 to 60-year-old
(b) Patient with knee, shoulder, and back injury
(c) On MRI, no major ligaments tear, which requires surgical management

Exclusion criteria

(a) Patients with significant ligament injuries that required surgical management
(b) Patients with neurovascular deficit

Written consent was obtained after a discussion about the study with the included population. The patients were divided into two groups: group C (Conventional) and group Y (Yoga group). Randomization was done using a random number table obtained from the computer and the closed envelopes of the patients were randomly distributed into two groups in a 1:1 ratio (C: Y group). Thus, 105 patients in group C and 107 patients in group Y were included. The conventional group patients received routine physiotherapy protocol, whereas patients in the yoga group received traditional physiotherapy combined with yoga (asanas) wherein the asanas were modified as per injury and requirement. We followed CLARIFY guideline in our yoga therapy as adopted by Moonaz *et al*.[11]

Delivery of yoga and its period, frequency, and duration of each yoga session in the hospital was monitored. After discharge, adherence to home practice was measured via WhatsApp or video chatting and physical attendance in OPD. Home practice or lesion of yoga was provided in the form of printed pictures of yoga assanas and videos uploaded on the mobiles of the patients. Periodic video chats, questioners, and physical follow ups in OPD was used as strategies and to promote practice adherence.

Baseline WOMAC scores for pain and stiffness were evaluated on the seventh postinjury day. The yoga group received yoga asanas at least once every day from the hospital yoga expert during their stay. At the time of discharge, patients were handed out written instructions and photographs of the asanas. All patients were followed up and WOMAC response was recorded at 6 weeks and 3 months from the day of discharge. All the patients were available for follow-up till 6 months as they resided in the same cantonment and could be contacted over the telephone. Frequency of yoga was advised 3 days/week after discharge from the hospital.

Initial management protocol involved only RICE for first 3–7 days (rest, ice, immobilization, and analgesic) and from 7–14th day, yoga was started by the instructor along with physiotherapy; after discharge, yoga was recommended thrice a week on their own via pictures/videos etc.

The yoga asanas are the combination of many body functional postures, which are included in the present study as shown in Figure 1.

For Knee injury

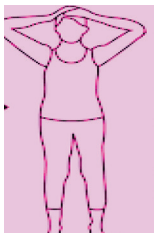
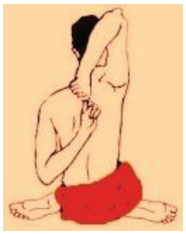
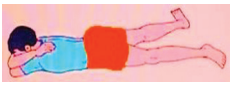
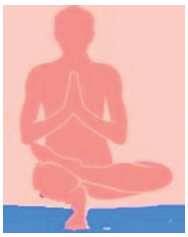
Regular physiotherapy: Ultrasonic and short-wave therapy for 5–7 days followed by hamstring and quadriceps strengthening exercises after 7th postinjury days.

Figure 1: Yoga asanas and their pictorial posture, used in the present study

Yoga asana	Posture
For Knee and Hip	
Tadasana	
Paschimottanasan	
Ardha shalabhasana	
Pavan-muktasana	
Baddhakonasana	
Virbhadrasana	
Utkatasana	
For Shoulder	
Shavasana	
Paschimottanasana	

Contd...

Figure 1: Contd...

Yoga asana	Posture
Tadasana	
Prasarita	
Padotanasana,	
Phalakasana,	
Gomukasana.	
For Back	
Shavasana, Bhujangasana,	
Makarasana Supta,	
padangustasana,	

Contd...

Figure 1: Contd...

Yoga asana	Posture
Tiryak Bhujangasana,	
Shashankasana,	
Supta padangustasana	
Parivrtta supata padangustasana	

Additional yoga asanas for yoga group

(a) 3–7 days postinjury: Shavasana, Tadasana, and Paschimottanasana was started twice daily for 10 min
(b) After 1 week: Pavanamuktanasana and Baddha-konasana was started thrice daily for 10 min
(c) 3rd week postinjury: Ardha shalabasana was started thrice daily for 10 min
(d) 6th weeks: Virbhadrasana and Utkatasana was started thrice daily for 15 min

For shoulder injury

Regular physiotherapy: Ultrasonic and short-wave therapy for 5–7 days followed by deltoid and rotator cuff strengthening and ROM exercises after 7th postinjury days.

Additional yoga asanas for yoga group

(a) 3–7 days postinjury: Shavasana, Tadasana, and Paschimottanasana was started twice daily for 10 min
(b) After 1 week: Garudasana and Parsvottanasana was started twice daily for 10 min
(c) 3rd week postinjury: Ardha shalabasana was started thrice daily for 15 min
(d) 6th weeks: Virbhadrasana II, Prasarita Padotanasana, Phalakasana, and Gomukasana was started thrice daily for 15 min

For back injury

Regular physiotherapy: After initial RICE application, hot pack therapy was applied for 20 min and ultrasonic therapy for 5 min in continuous form at a frequency of 1 MHz and a density of 1.5 W/cm^2 daily for 7 days. Additionally, TENS (Transcutaneous epidermal nerve stimulation) treatment was provided in continuous form with strength of 100 Hz, 40 μSN for 30 min after 7th postinjury days for thrice a day for 7 to 10 days.

Additional yoga asanas for yoga group

(a) 3–7 days postinjury: Shavasana and Bhujangasana was started twice daily for 10 min
(b) After 1 week: Makarasana Supta was started twice daily for 10 min
(c) 3rd week postinjury: Padangustasana was started thrice daily for 15 min
(d) 6th weeks: Tiryak Bhujangasana, Shashankasana, Supta padangustasana, and Parivrtta supata padangustasana was started thrice daily for 15 min

All yoga sessions were delivered using audio-visual screen in the presence of yoga instructor.

Sample size calculation

For each group to achieve a power of 80% and a level of significance of 5% (two sided), for detecting a true difference in means between the test and the reference group of a sample size of 10 units in total comes to 72 (assuming equal size group, 36 in each group). At 95% confidence interval ($\alpha = 0.05$) with population variance of 0.64° and 80% power ($\beta = 0.2$), was 385. Considering 10% was lost to follow up during a study period, a sample size of 36 patients in each group was required (our $N = 105$ and 107).

Statistical analysis

We used SPSS version 19 (IMB USA) and MS Excel 2007 for data analysis. Relative differences were calculated for the time duration in both groups, and Mann–Whitney U test was used to compare. Wilcoxon sign ranked test was used for paired scores. Spearman's correlation coefficient was used for comparison and Mann–Whitney *U* test was used for the difference between genders in functional scores. The level of significance was taken when $P < 0.05$.

Results

We divided our study population into two groups: Conventional group (C group) with 105 patients and Yoga group (Y group) with 107 patients with mean age 37.5 ± ± 4.12 and 36.3 ± 3.27 years, respectively. There were 72 males and 33 females in C group and 89 males and 18 females in Y group. The mean BMI for all the subjects was 23.34 ± 9.45 (16.3–35.4). Cricket and football contributed to a significant amount of injuries while knee joint was predominantly involved [Table 1].

The mean scores of WOMAC pain and stiffness and the function score at 7th postinjury day at 6 weeks, 3 months, and 6 months were recorded and a significant difference in pain and stiffness was noted at 6 months with C group: 6.33 ± 1.34. In Y group, it was 1.66 ± 1.12 ($P = 0.0024$) [Table 2].

We recorded lower absolute values of the variables in the yoga group than in the conventional group. We considered the 7th postinjury days as the baseline and compared it with subsequent follow-ups at 6 weeks, 3 months, and 6 months. We recorded a significant improvement in all scores at 6 weeks,

3 months, and 6 months as compared with the 7th postinjury days in both the groups [Table 3].

While comparing the percentage reduction in pain and stiffness at 6 months in both groups, we recorded significant improvement in WOMAC scores in yoga group (48.52 vs. 9.11, $P = 0.0012$) as compared to conventional group. We also noted significant overall functional improvement in yoga group (63.23 vs. 23.65, $P = 0.0011$) as compared to conventional group [Table 4].

Table 1: Demographical characteristics of the study population

Parameters	C-group (*n*=105)	Y group (*n*=107)	*P*
Mean Age in years	37.5±4.12	36.3±3.27	0.361
Sex			
Male	72	89	0.562
Female	33	18	0.024
BMI (in kg/m^2)			
16-18.5 (mean 13±6.12)	13	9	0.043
18.5-25 (mean 15±12.43)	49	63	0.051
25-30 (mean 18±13.17)	34	29	0.673
30-35 (mean 26±16.23)	9	6	0.624
Mode of Injury			
Badminton	17	11	0.545
Cricket	23	29	0.442
Football	41	36	0.723
Running	15	19	0.651
Basketball	9	12	0.035
Site of injury			
Shoulder	17	12	0.675
Knee	77	79	0.645
Back	11	16	0.623
Types of injury			
Knee MCL sprain	23	31	0.692
Hamstring strain	29	23	0.765
Knee LCL sprain	9	4	0.612
Quadriceps strain	18	28	0.021
Knee fat pad injury	11	7	0.042
Patello-femoral pain syndrome	19	14	0.373
Biceps tendinitis Shoulder	8	2	0.056
Acromioclavicular joint sprain	5	3	0.512
Rotator cuff injury shoulder	4	7	0.564
Lumbar sacral strain	9	7	0.673
Acute muscle spasm of lower back	8	9	0.576

Discussion

The objective of our study was to evaluate the effects of additional yoga combined with regular or conventional physiotherapy for functional outcome of patients after various sports injuries. We noted that patients using yoga experienced better pain relief, less stiffness, and better outcome. We did not record any adverse effects in any group. We believe yoga asanas are safe for rehabilitation following various sports related injuries, which were treated nonsurgically as few published data supports our view.[12,13]

In the present study, we noted that pain relief was significant in yoga group, as compared to the regular therapy group. Our finding is supported by similar results obtained by few authors.[1–3,12] Role of yoga in osteoarthritis knee and chronic back pain has been recorded by Kolasinski *et al*.[14] and Chang *et al*.,[15] respectively. However, Sadiri *et al*.[16] and Garfinkel *et al*.[17] reported a favorable outcome in pain relief in musculoskeletal discomfort and in carpel tunnel syndrome of wrist post yoga, respectively. They also recorded that yogasanas are beneficial in reducing the intensity of pain and improving function. From the above published data, it is encouraging to add additional yoga therapy along with conventional physiotherapy for faster rehabilitation.

Shavasana had contributed in the reduction of pain by relaxation of Musculoskeletal system. This further reduces nerve signals and helps in the relaxation of the skeletal muscles.[18,19]

Stimulation of inhibitory pain pathways can be activated by the conscious relaxation in Shavasana. It would help in reduction of impulses in the motor neuron and thus assist in muscle relaxation and in turning pain to relief.[18,19] Therefore, the yoga group experienced the dual advantage of muscle strengthening and

Table 2: Pain, stiffness and function subscale of WOMAC scale in conventional and Yoga group at 7th postinjury day, 6 weeks, 3 months, and 6 months

Group	Pain and stiffness				Function		
	7th days postinjury	6 weeks	3 months	6 months	6 weeks	3 months	6 months
C	35.54±6.12	21.23±5.42	12.38±4.11	6.33±1.34	13.09±4.22	9.44±3.25	7.02±2.88
Y	30.24±8.18	16.31±3.04	4.01±4.08	1.66±1.12	10.32±5.16	5.03±4.09	5.41±1.31
P	0.0021*	0.0034*	0.0042*	0.0024*	0.0033*	0.0014*	0.00132*

*Denote significance

Table 3: Pain, stiffness and function subscale of WOMAC scale in both groups

Group	Pain and stiffness				Function		
	7th days postinjury	6 weeks	3 months	6 months	6 weeks	3 months	6 months
C	*P*=0.002	*P*=0.003	*P*=0.004	*P*=0.002	*P*=0.004	*P*=0.003	*P*=0.005
Y	*P*=0.001	*P*=0.002	*P*=0.001	*P*=0.003	*P*=0.001	*P*=0.002	*P*=0.003

Mann-Whitney u test was used to compare between both groups for which $P<0.05$

Table 4: Percentage reduction in pain, stiffness and function subscale of WOMAC scale in conventional physiotherapy and physiotherapy combined with Yoga group

Group	Improvement in Pain and stiffness at 6 weeks (%)	Improvement in Pain and stiffness at 3 months (%)	Improvement in Pain and stiffness at 6 months (%)	Improvement in Function at 6 months (%)
C	18.12	12.43	9.11	23.65
Y	24.86	32.18	48.52	63.23
P	0.0027	0.0032	0.0012	0.0011

Percentage reduction of pain, stiffness score at 6 weeks, 3 months, and 6 months, compared to 7th postinjury days, and percentage reduction in function score at 6 months compared to 6 weeks.

relaxation of the muscles enabling faster recovery. Bera *et al*.[20] and Sharma *et al*.,[21] have found Shavasana as very effective in reducing the effects of stress. Büssing *et al*.[22] and Malathi *et al*.[23] recorded positive effects of yoga on subjective well-being. Hagins *et al*.[24] and Chaudhary *et al*.[25] noted positive effects of Shavasana in hypertension. Streeter *et al*.[26] noted a 27% increase in GABA levels in 19 patients in the yoga practice group than walking group after the yoga session (0.20 mmol/kg). They also reported more improvement in mood and anxiety after the 12-week yoga compared with an only walking exercise group.

According to Maughan RJ and Shirreffs SM, after the injury, muscles around joints usually develop spasms and tightness because of the acute phase.[27] After the acute phase, gait difficulties may appear due to low pain tolerance, which directly affects the knee and hip flexors.

Muscle spasm can be reduced by various physiotherapy protocols and there was significant improvement in both the groups in our study as well. By adding yoga asanas, it may influence many body parts in a positive way.

Yoga asanas like Virabhadrasana, Ardha-shalabhasana, Badhakonasana, Pawanamuktasana, Utkatasana, Utthita Trikonasana, and Bhujangasana involve isometric contraction of agonists and stretching of antagonists.[8] Kisner C in his book described that Shavasana helps in relaxation and improvement of psychological well-being.[28] Holding postures leads to increase in joint stability, relaxation of muscles in spasm improving their excursion around the joints, thus overall improvement in function and pain relief. Many authors noted the role of Golgi tendon organs (GTO) in muscle relaxation during Yoga practice.[29–32] They also noted that during yoga, on applying slow stretch to the muscle, firing of GTO occurs and reduces tension in the muscle, allowing it to relax.

Carlson *et al*.[33] demonstrated that yoga stretches the muscle and tendon and reduces pain and suffering in the study population. Stretching of muscle affects EMG activity of the muscles. Therefore, relaxation of muscle and tendon leads to a feeling of well-being. Hip and back pain can be improved by using Ardha Shalabhasana, which acts on the hip flexor, back extensors muscle, and forward placement of the pelvis and trunk. That may shift the center of gravity slightly anterior to the hip and lead to relaxation of these muscles. Thus, by doing so, Ardha Shalabhasana stretches the hip flexors and extensors, which helps to reduce the spasm and improve function and gait.

Yoga, along with conventional physiotherapy, has demonstrated improvement in knee function and quality of life in patients with sport injuries treated nonsurgically. This could be possible because yoga has the ability to offer better emotional stability.[34–36] In many sports, it has been noted that the injured patients are psychologically depressed of fear whether they will ever return to sports and if injury will have an adverse impact on outcomes. Many authors have reported the beneficial effects of yoga in psychological distress.[37–40] Various authors noted that yoga helps in reducing psychological stress. It further induces pain relief through increased endorphins secretion in the brain, which improves function.[41–43]

Mechanism of effects of yoga

Mahajan[44] has recorded the mechanisms involved in the therapeutic effects of yoga. Yoga may have influence on the central nervous system, ANS, limbic system, HPA (Hypothalamo pituitary adrenal) axis, and the immune system to work together to maintain the hormonal homeostasis as shown in Figure 2.

Yoga and hormones/neurotransmitters

Many authors studied and evaluated the effect of yoga in the endocrine homeostasis. Walton *et al*.[45] and Jevning *et al*.[46] have noted that plasma cortisol and testosterone concentration changes during the "transcendental meditation." Arora *et al*.[47] observed effect of yoga on stress and the immune system and noted that yoga plays a vital role in regulating the cytokine levels and hence, the immune responses during stress. Bevan[48] reported an alteration in hypothalamic and pituitary function following yoga. Vandana *et al*.[49] have shown a decrease in the serum adrenaline and cortisol levels following Amrita meditation. Vera *et al*.[50] have reported an increase in serum cortisol level in patients involving long-term yoga practices.

Yoshihara *et al*.[51] noted that decreased levels of 8-hydroxydeoxyguanosine may be an indicator of psychological stress. Newberg *et al*.[52] recorded increased levels of β endorphin in the individuals practicing yoga daily.

Chatterjee *et al*.[53] recorded improvement in T4, T4, and TSH level following yoga therapy; similarly, Chatterjee *et al*.[54] observed improvement in GH (growth hormone) and dehydroepiandrosterone sulfate (DHEAS) level following yoga therapy. However, yogic practices such as the Sarvangasana increases the protein bound serum iodine and

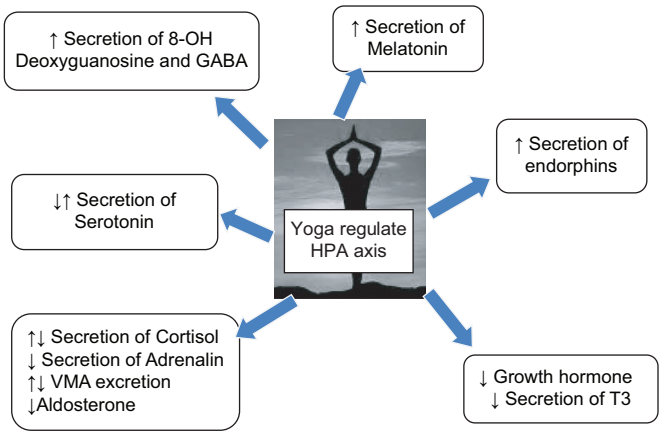


Figure 2: Yoga regulates the level of hormones and neurotransmitters that affect physiological functions

improves function of the thyroid gland.[53,55] Streeter *et al*.[56] noted a sharp increase in GABA following an hour of yoga practice, as shown by magnetic resonance spectroscopy. Both Shettyet *et al*.[57] and Jevning *et al*.[58] have noted the increased level of serum prolactin following meditation, especially "sudarshan kriya".

Yoga in specific condition

(a) **Back pain**: In spinal region, mal-alignment of the musculoskeletal components of neck and lower back is the commonest cause for backache and neck pain. Relaxation asanas [shavasana, makarasana] followed by stretching [ardhamatsyendrasana, ardhakati chakrasana,] and muscle strengthening asanas [Bhujangasana and shalabhasana] help, as suggested by Williams *et al*.[59] However, strengthening asanas should not be incorporated too early as they can aggravate the pain.

(b) Neuropathic pain: Neuropathic pain is caused by nerve damage proximal to the sensory nerve endings or over stretching. A holistic approach is to be adopted for recovery. Yogas like "yoga nidra" with visualization, body awareness, breathing, and gentle equivalent stretch asanas is used for muscle group relaxation. Garfinkel *et al*.[17] demonstrated that by improving flexibility; correcting alignment of shoulder, arms, wrist, and hand is important in alleviation pain. He also advocated stretching and increasing awareness of optimal joint position to minimize symptoms of specific areas like carpal tunnel syndrome.

(c) **Knee pain:** Few authors reported encouraging results of yoga in knee rehabilitation following surgery on skier, and they suggested that yoga and physiotherapy as a combined modality may increase the biological and psychological well-being.[10]

Recently, Sharma *et al*.[60] included patients of 18–60 years in a randomized wait list-controlled trial; diagnosed with musculoskeletal conditions including rheumatoid arthritis, osteoarthritis, low back pain, joint pain, muscle pain, or chronic nonmalignant pain with mild to moderate intensity. He noted that after 16 weeks of yoga, an effective pain relief was achieved in patients with chronic musculoskeletal pain**.** To summarize, all these cumulative data suggest that yoga greatly influences endocrine homeostasis and plays a vital role in psychological well-being, cheerfulness, modified immune system, and overall musculoskeletal function.

Limitations of the study

The study includes a few limitations that need to be addressed. First, level of activities and environment in which injury occurred were not considered. Second, seasonal variation of these injuries was also not considered. Third, the difference in number of women patients in the control versus yoga group is also a limitation of this study.

Role of primary physician

Primary physician can play a vital role in timely and supervised yoga sessions and provide awareness regarding importance of yoga in sports injury rehabilitation.

Key point: The results of present study indicated that when yoga combined with conventional physiotherapy in rehabilitation of sports related injuries gives better result as compared with physiotherapy alone.

Conclusion

The present study showed that the yoga group experienced significant improvements in all WOMAC scale subscales compared to the conventional physiotherapy group. A more extensive randomized controlled study will be required to validate the results further to reach a definitive conclusion. Yoga may influence the pain pathway and its management and improve function in sports injury when used in conjunction with conventional physiotherapy.

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Declarations

(a) Declaration of Conflicting Interests: The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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(c) Authors declare no patents, no copyrights, or royalties applicable to present study.

(d) Authors also declare no relationships or activities that could have influenced the content of the submitted work.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have

given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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