



Original Research Article (Clinical)

## Protocol based management of common sports injuries by integrated approach of *Sandhi Marmabhighata* - An open labeled clinical trial

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## ABSTRACT

**Background:** Sports injuries are the second most common type of accident after domestic (3.7%) and occupational accidents (3.1%). There is an average annual estimate of 8.6 million sports and recreational related injury incidents with an age-adjusted rate of 34.1 per 1000 populations. Common sports injuries are musculoskeletal injuries i.e. Sprains, Strains, Joint injuries, soft tissue injury (STI). The sports injury in Ayurveda can be co-related within dissimilar facets of trauma related ailments.

**Objective:** To evaluate the efficacy of a protocol-based management of common sports injuries using an integrated approach.

**Materials and methods:** Integration of Ayurveda and Physiotherapy procedures was done and phase wise treatment was framed. Total 30 patients of age between 10 and 60 years fulfilling the inclusion criteria were selected for the present study. The patients were treated with Phase wise protocol consisting of three phase's i.e. Inflammatory (1–5 days), Stabilization and recovery (6–10 days), Muscle strengthening (11–17 days). Assessments were done through various variables like pain, tenderness, swelling, local temperature, manual muscle testing (MMT) and range of motion (ROM) at different time points.

**Statistical analysis:** Wilcoxon matched pair test was used to assess within group results for subjective parameters and paired t-test (Dependent t-test) was used to assess for objective parameters.

**Result:** The study showed that integrated treatment approach has given significant results in the parameters like pain, loss of function, tenderness, local temperature, MMT and ROM.

**Conclusion:** Phase wise management through integrated protocol is effective in the management of common sports injuries.

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### 1. Introduction

Sports and exercise medicine is defined as that discipline which treats any kind of injury, pain or physical damage that occurs as a result of sport, exercise or physical activity [1,4]. As the sports buzz is rising in these days, sports injuries are inclining especially in the areas of the joints like the ankle, elbow, wrist, knee etc. [5]. Soccer (30.6%), and kabaddi (20.9%) were the sports causing knee joint injuries, among cricketers 16.8% suffered upper limb injuries [3,13]. Individuals between 5 and 24 years of age accounted for more than 50% of all injury incidents [2].

As per Ayurveda, sports injuries are a kind of traumatic diathesis in which *Vatadidosha* (bodily humors) are provoked that may lead to pain and others symptoms at the site of affliction [6]. The

etiology, sign and symptoms of *Sadyo-Vrana* (Trauma), *Bhagna* (Fractures) and *Marmabhighata* (soft tissue injuries) when they are collectively analysed, they can be correlated to sports injuries [7]. *Ayurveda* classics have emphasized rehabilitation of injured person in case of *Bhagna*, *Vrana* and *Marmabhighata* and highlighted individualised treatment approach based on *Dosha* for a better outcome [6,7]. Conventional approaches to sports injuries include PRICER (Protection, Rest, Ice, Compression, Elevation and Rehabilitation) protocol, anti-inflammatory drugs, analgesics, immobilization, corticosteroid injections, physiotherapy and surgery [8]. Prolong usage of analgesics have high incidence of intolerable gastrointestinal side effects and other systemic side effects [9].

The treatment principle of *marmabhighata* includes both internal and external remedies like *lepa* (medicated paste) application, *bandhana* (Bandaging), *pichu* (oil cotton Swab) and various *Panchakarma* (Five treatment procedure) procedures like *Abhyanga* (massage), *Snehana* (oilation), *Swedana* (Fomentation therapy) etc.

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[7]. The Integration of complementary and alternative medicine into the sport arena helps in prevention, treatment of sports injuries and increases sport men performances [10]. Effective management of sports injuries requires phase wise assessment of injuries and preparation of special protocol by incorporating various procedures of *Ayurveda* and physiotherapy for better outcome. Hence the present study was designed to evaluate the efficacy of protocol based management of common sports injuries by integrated approach.

## 2. Materials and methods

The patients attending outpatient and inpatient department of the institute were recruited for the study. The CONSORT [11] statement guidelines are followed for reporting the outcomes of the study.

### 2.1. Raw drugs and finished products

Procurement of raw drugs and preparation of *Manjishtadi lepa churna*, *Bhadarakadi Ghrita* were done at KAHER GMP certified Ayurveda pharmacy. *Shatadhauta Ghrita* was procured from KAHER GMP certified Ayurveda pharmacy. Authentication of raw drugs and analysis of finished product were done at AYUSH certified drug testing central research facility of our institute. *Marma Gutika*, *Murrivena taila* and *Balaarishta* were procured from GMP certified Kerala Ayurveda pharmacy.

### 2.2. Subjects

Total 30 patients diagnosed with sports injuries were recruited from the OPD and IPD of the Shalya tantra Department, KLE Ayurveda Hospital, Shahapur, Belagavi.

### 2.3. Inclusion criteria

Diagnosed case of Common sports injuries within 7 days, either sex with age ranging from 10 to 60 years and complaining of pain, swelling, restricted joint movement were included in the study.

### 2.4. Exclusion criteria

Patients suffering with systemic diseases like diabetes mellitus, tuberculosis, malignant wounds, bleeding disorders; patients having a fracture with partial or complete displacement, deformity of joints. Pregnant and lactating females; patients with history of road traffic accidents with Medico legal cases were excluded.

#### Screening methods:

The recruited patients in the study were clinically examined and data were recorded systematically. X ray of particular joint was carried out at the Radiology department of our institute in order to rule out fracture and dislocations.

### 2.5. Research design

The study is a single group pretest-posttest quasi experimental clinical trial with a sample size of 30. The CONSORT Flow diagram of the study is provided in the Fig. 1.

### 2.6. Treatment protocol

The flow chart of the treatment protocol is provided in the Fig. 2.

### 2.7. Intervention

The duration of the intervention was 17 days; the informed consent was taken from the patients after orienting the nature

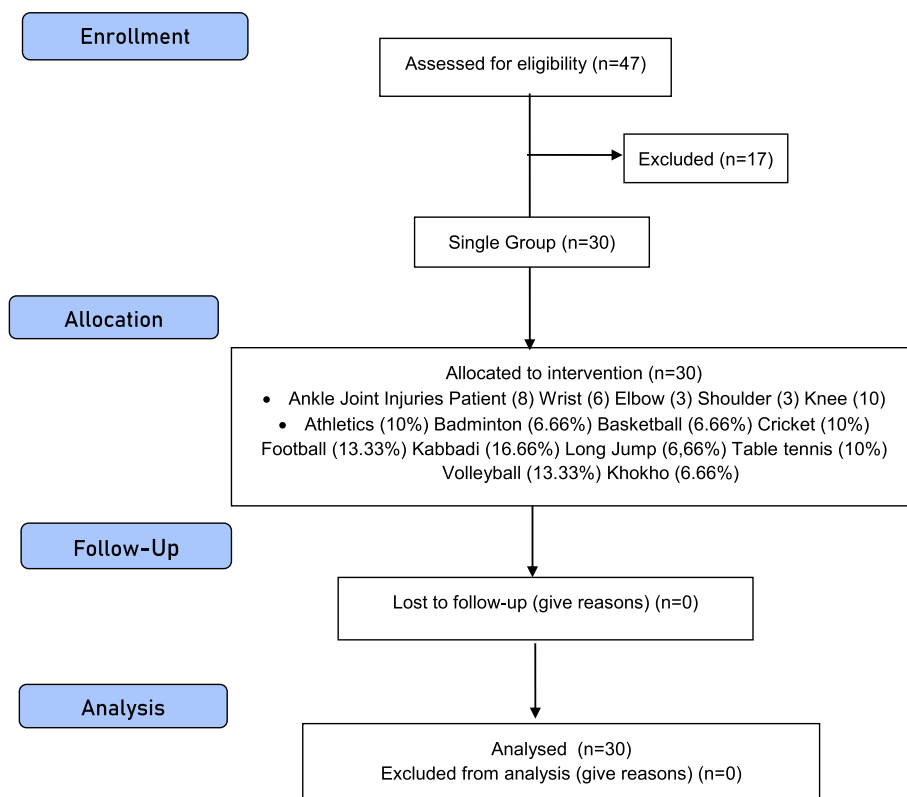


Fig. 1. CONSORT flow diagram of the study.

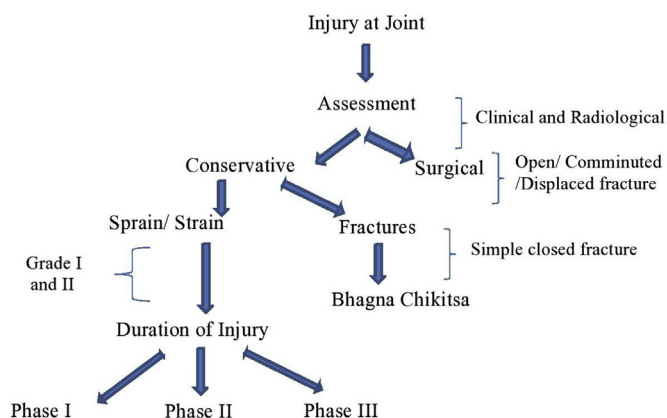


Fig. 2. Treatment protocol.

and design of the study. The study was approved by the Institutional Ethics Committee with Protocol Id BMK/17/PG/SL/5, Date of Approval 18.10.2019. CTRI Registration Number CTRI/2018/07/014910. Data collection was done since February 2018 to February 2019. During the study period, patients were asked to adhere the treatment protocol and report any adverse events to the investigators. Physiotherapy procedures were carried out under the instructions of qualified physiotherapist of our institute.

2.8. Criteria for assessment

2.8.1. Primary outcomes (Fig. 3)

Parameters like Pain (by Verbal descriptive scale), Tenderness (by modified Cipriano Scale), Swelling (graduation of length and breadth by using inch tape), Range of Motion of Joints (by Goniometry), Temperature (by infrared thermometer), Manual muscle testing grade (modified Cipriano scale) were assessed at different time points using standard operative procedures.

2.9. Statistical test

Statistical analysis was carried out using SPSS version 20.0. Comparison of different interventions from Base line to day 17 with

respect to parameters like pain and tenderness were assessed by Wilcoxon matched pair test and the rest of the parameters were assessed by Paired t-test (Dependent t-Test). Values were reported as mean ± standard deviation and the parameters were considered statistically significant if the 'p' value is < 0.05.

3. Results

Study was completed with participation of total 30 patients without any reported adverse events and drop outs.

3.1. Subject characteristics

Age - 13% of the patients were from 10 to 20 yrs, 23% from 20 to 30 years, 20% from 30 to 40 years, 10% from 40 to 50 years, 34% from 50 to 60 years.

Sex - 60% of the patients were male and 40% were female in the present study.

Site of Injury - In the present study knee joint injuries were 33% (football, kabaddi, long jump, athletics), ankle injury 27% (volleyball, kabaddi, kho - kho), wrist injury 20% (table tennis, volleyball), and 10% each in elbow (cricket, badminton, table tennis), and shoulder joint injury (volleyball, basketball, kabaddi).

Type of sports involved - athletics (10%), badminton (6.66%), basketball (6.66%), cricket (10%), football (13.33%), kabaddi (16.66%), long jump (6.66%), table tennis (10%), volleyball (13.33%), kho kho (6.66%).

3.2. Primary outcome

Statistically significant results (p < 0.05) were seen in the parameters like pain, tenderness, swelling, local temperature, manual muscle test and range of motion of all major joints except shoulder, knee extension and elbow joint in all the three time points. Comparison of phase wise interventions showed significant improvement (p < 0.001) in the pain and tenderness parameters on 1–6th, 1–11th and 1–17th day. Significant improvement (p < 0.001) was seen in the parameters like swelling, local temperature and manual muscle test on three different time points i.e. 1–6th, 1–11th and 1–17th day. Significant improvement (p < 0.05) was seen in the range of motion, i.e. Overall joint extension [1–6th day (p = 0.003)



Fig. 3. Assessment of injured joint (Inch Tape measurement, Infrared thermometer and Goniometry).



Fig. 4. Various treatment procedures (Murinenna pichu, Manjistadi Lepa and Splint application).

**Table 1**  
Phase wise allotment of Ayurveda and Physiotherapy Procedures.

S. No	1st Phase (1–5 days) Immediate rehabilitation (Control of pain and Inflammation)	2nd Phase (6–10 days) Intermediate rehabilitation (Repair and regeneration of tissue and improve muscle performance)	3rd phase (11–17 days) Advanced rehabilitation (Muscle strengthening and restoring ROM)
1	Local application at affected joints with <i>Manjishtadi lepa</i> twice daily	<i>Murrivena taila pichu</i> application at affected part twice daily and <i>Bandhana</i>	<i>Sthanika abhyanga</i> with <i>Murrivena taila</i> followed by <i>Shastika shali pinda sweda</i>
2	Immobilization of affected part with <i>Bandhana</i> as per required (elastic crepe bandage, splint application, sling bandage)	TENS- 10 Min, Isometric Exercises to improve tone of muscles.	Interferential Therapy- 10 min Ultrasound therapy- 5 min muscle strengthening Exercise
3	Internal medication <i>Marma gulika</i> 1 tablet three times daily after food. <i>Bhadarakadi Ghrita</i> 10 ml twice daily after food with warm water.	Internal medication <i>Marma gulika</i> 1 tablet Three times daily after food. <i>Bhadarakadi Ghrita</i> 10 ml twice daily after food with warm water.	Internal Medication <i>Balaarishtha</i> 20 mL thrice daily after food with equal quantity of water

and 1–11th, 1–17th day ( $p < 0.001$ ), Overall joint flexion ( $p < 0.001$ ) at all three time points. Significant improvement ( $p < 0.05$ ) was seen in individual joint ROM, particularly with wrist joint (flexion, extension, radial and ulnar deviation), ankle (inversion, eversion, dorsal and plantar flexion), knee (flexion) and elbow flexion. Insignificant changes were seen in shoulder joint (abduction, adduction, flexion, extension, external Rotation), elbow (pronation, supination) and knee extension movements. All the movements were non weight bearing with active ROM.

**4. Discussion**

Rehabilitation of sports injuries includes four phases, i.e. immediate (control of pain and inflammation), intermediate (repair and regeneration of tissue and improve muscle performance), Advanced (muscle strengthening and restoring ROM) and return to play [12,13]. Evidence based practices are essential to forecast the efficacy of Ayurveda in managing sports injuries, to fulfil that

objective framing of integrative protocol by incorporating Ayurveda and physiotherapy procedure as per phase wise was planned. Concept of rehabilitation in injured person is well highlighted by Ayurveda classics which include *Lepa* (paste) and *Kusha* (splint) application, *Aanchana* (traction), *Pidana* (manipulation), retention by *Bandhana* (bandaging), *Kapata shayana* (immobilisation by splint application with 5 nails), muscle strengthening exercises like holding of mudball, salt ball and stone ball in upper limb injury [6,7].

**4.1. Immediate rehabilitation (control of pain and inflammation)**

Ayurveda classics explains the pathophysiology of acute injuries (*Sadyo Varna*) leading to vitiation of *vata*, *rakta* and *ushna* producing symptoms like pain, swelling, deformity and loss of function [14]. Management principles of *marmaghata*, *sadyo vrana* and *bhagna* are implemented in sports injury management, which advises cold paste (*ML*) application followed by bandaging etc immediately after

**Table 2**  
Comparison from day 1 to day 17 with parameters like pain, loss of function, local temperature (° F), tenderness, swelling (cm) and manual muscle testing by Wilcoxon matched pair test to assess improvement in individual joint injury.

Parameters	Joint	Time periods	Mean change	SD changes	%of change	Z-value	p-value
Pain	Ankle	Day 1–day 17	7.25	1.39	72.50	2.5208	0.0117*
		Day 1–day 17	6.30	1.34	70.00	2.8031	0.0051*
	Knee	Day 1–day 17	4.67	1.15	58.33	1.6036	0.010*
		Day 1–day 17	5.33	1.15	61.54	1.6036	0.0108*
	Shoulder	Day 1–day 17	4.33	0.82	50.00	2.2014	0.0277*
Loss of function	Ankle	Day 1–day 17	1.63	0.52	86.67	2.5205	0.0117*
		Day 1–day 17	1.50	0.71	93.75	2.6656	0.0077*
	Knee	Day 1–day 17	1.00	–	100.00	1.6036	0.010*
		Day 1–day 17	1.33	0.58	100.00	1.6036	0.0108*
	Shoulder	Day 1–day 17	1.17	0.41	77.78	2.2014	0.0277*
Local temperature	Ankle	Day 1–day 17	0.96	0.44	1.00	2.5205	0.0117*
		Day 1–day 17	1.19	0.62	1.21	2.8031	0.0051*
	Knee	Day 1–day 17	0.50	0.26	0.52	1.6036	0.010*
		Day 1–day 17	0.73	0.15	0.76	1.6036	0.0108*
	Shoulder	Day 1–day 17	0.53	0.23	0.55	2.2014	0.0277*
Tenderness	Ankle	Day 1–day 17	2.50	0.53	62.50	2.5205	0.0117*
		Day 1–day 17	2.30	0.48	67.65	2.8031	0.0051*
	Knee	Day 1–day 17	2.67	0.58	72.73	1.6036	0.010*
		Day 1–day 17	2.00	1.00	66.67	1.6036	0.0108*
	Shoulder	Day 1–day 17	2.33	1.03	63.64	2.2014	0.0277*
Swelling	Ankle	Day 1–day 17	1.38	0.66	5.86	2.5206	0.0117*
		Day 1–day 17	0.99	0.38	2.70	2.8031	0.0051*
	Knee	Day 1–day 17	1.93	0.90	5.23	1.6036	0.010*
		Day 1–day 17	1.03	0.15	3.14	1.6036	0.0108*
	Shoulder	Day 1–day 17	0.85	0.36	6.26	2.2014	0.0277*
Manual muscle testing	Ankle	Day 1–day 17	1.63	1.69	92.86	1.8904	0.0487*
		Day 1–day 17	–2.30	0.67	–153.33	2.8031	0.0051*
	Knee	Day 1–day 17	–2.00	–	–75.00	1.6036	0.010*
		Day 1–day 17	–1.33	0.58	–57.14	1.6036	0.0108*
	Shoulder	Day 1–day 17	–2.00	–	–120.00	2.2014	0.0277*

Note - \*p < 0.05.

**Table 3**  
Effect of overall joint parameters expressed in Mean and standard deviation (S.D).

Parameter	Baseline	6th day	11th day	17th day
Pain (VDS)	9.07 ± 1.14	7.40 ± 1.50***	5.60 ± 1.40***	3.17 ± 1.51***
Loss of Function	1.57 ± 0.50	1.27 ± 0.45***	0.70 ± 0.47***	0.17 ± 0.38***
Tenderness (modified di-Cipriano scale)	3.60 ± 0.56	2.80 ± 0.61***	2.21 ± 0.56***	1.23 ± 0.50***
Local Temperature	96.85 ± 2.05	96.64 ± 2.11***	96.36 ± 2.02***	95.96 ± 1.96***
Swelling	28.20 ± 10.50	27.86 ± 10.55***	27.40 ± 10.49***	26.97 ± 10.40***
Manual muscle testing	1.80 ± 1.00	2.40 ± 0.72***	3.00 ± 0.83***	3.73 ± 0.78***
<b>Active Range of motions - Non weight bearing</b>				
Wrist flexion	47.67 ± 5.01	52.33 ± 4.08*	56.33 ± 3.50*	60.00 ± 0.00*
Wrist extension	49.67 ± 4.93	52.50 ± 4.59*	56.00 ± 3.74*	58.83 ± 2.04*
Wrist radial deviation	13.00 ± 1.26	14.67 ± 1.37*	17.67 ± 1.97*	19.67 ± 0.82**
Wrist ulnar deviation	17.83 ± 3.97	20.83 ± 5.34*	22.67 ± 5.16*	23.17 ± 4.79*
Shoulder flexion	153.33 ± 15.28	162.67 ± 14.19	168.33 ± 10.41	180 ± 0.00
Shoulder extension	35.33 ± 0.58	38.33 ± 3.51	42.00 ± 5.29	47.33 ± 1.15
Shoulder abduction	151.67 ± 18.93	162.67 ± 15.70	168.33 ± 7.64	175.33 ± 0.58
Shoulder Adduction	69.33 ± 10.07	71.67 ± 7.64	78.00 ± 10.00	85.00 ± 7.81
Shoulder lateral external rotation	77.67 ± 8.74	81.67 ± 5.77	83.33 ± 7.64	89.33 ± 1.15
Elbow flexion	98.33 ± 18.93	113.33 ± 20.82	128.33 ± 7.64	140.00 ± 0
Forearm pronation	59.33 ± 9.02	69.00 ± 7.94	72.67 ± 11.02	78.67 ± 2.31
Forearm supination	66.67 ± 2.89	68.00 ± 8.19	75.00 ± 0.00	80.00 ± 0.00
Ankle dorsiflexion	14.88 ± 2.59	17.25 ± 1.58*	17.88 ± 1.13**	19.75 ± 0.71***
Ankle plantar flexion	27.25 ± 4.53	30.38 ± 5.10*	33.75 ± 4.43***	36.63 ± 4.44***
Ankle inversion	27.25 ± 1.49	29.25 ± 1.58***	30.75 ± 1.49***	33.63 ± 1.77***
Ankle eversion	8.00 ± 0.53	8.63 ± 0.74***	10.25 ± 0.46***	11.13 ± 0.64***
Knee flexion	134.00 ± 16.32	136.10 ± 17.06***	141.60 ± 14.89	145.70 ± 9.15
Knee extension	0.70 ± 0.95	0.30 ± 0.67	0.30 ± 0.48	0.20 ± 0.42

Note - \*(p < 0.05), \*\*(p < 0.01), \*\*\*(p < 0.001).

injury [14,15]. *Manjishtadi lepa* (Fig. 4) (Tables 1 and 2) application in inflammatory stage i.e immediate rehabilitation helps in reduction of pain, swelling and temperature [16]. The local application of cold therapy agents suppresses the metabolic rate of the surrounding soft tissue and lowers microcirculation or perfusions of capillaries beneath the injured tissue by more than 60%, thus reducing extravasation of blood into surrounding tissues, local inflammation and decreases in motor and sensory nerve conduction [17]. Early Immobilization (Fig. 4) (Tables 1 and 2) of affected joint with *kusha* (splint) application helps in reduction of blood flow, facilitating the translocation of edema from the injured site to proximal normal tissues where it is effectively evacuated by the lymphatic system [18]. Previous studies states that combined effect of cold and compression helps in temperature reduction and speeds up the lymph evacuation process [19]. *Bhadarakadi ghrta* (Ghee preparation with medicated drugs) (Tables 1 and 2) a formulation popularly known as '*param rujahara*' (alleviates pain) specially indicated in *marmaghata* (injury to vital points) [20]. *marma gutika* (Table 1) containing 35 drugs indicated in the pain management of injury to vital structures [20].

#### 4.2. Intermediate rehabilitation (repair and regeneration of tissue and improve muscle performance)

*Murrivenna* oil (Tables 1 and 2) is known for its anti-inflammatory activity, thus application in *pichu* form (Fig. 4) increases drug skin contact time, permeability of the skin and enhances the bioavailability of the drugs thus providing a synergistic effect to reduce pain and swelling [21]. TENS (Fig. 5) is simple and non-invasive treatment indicated in the treatment of acute and chronic pain [22,23]. In this procedure, electrical current is provided through the skin which reduces central excitability thus inhibiting the nociceptive neurons of the spinal cord there by reduces pain (pure gate theory) [24]. Isometric exercises (IM) (Table 3) are important in the early phase of rehabilitation to minimize muscle atrophy [24,25]. In an immobilized joint practice

of IM helps in protecting the integrity of joint structure, stimulates muscle fibers, improves local blood circulation and also prevents intra articular, peri articular adhesions thus enhancing range of joint motion [25].

#### 4.3. Advanced rehabilitation (muscle strengthening and improve ROM)

Inferential therapy (Fig. 5) is indicated for pain relief in musculoskeletal injuries and researches have proved that it does stimulation of muscles, reduces swelling and boosts up the healing process [23,26]. Incorporating muscle strengthening exercises (Tables 2 and 3) in the earlier phase helps in improving muscular strength, dynamic postural stability and endurance of sports person



Fig. 5. Physiotherapy procedures (TENS, IFT and Ultrasound) and Bandaging.

[27]. It also prevents complications like reduced range of motion, adhesions, contractures and muscle wasting [28]. Ultrasound therapy (Fig. 5) (Tables 2 and 3) improves local blood flow, reduces inflammation, pain, muscle spasm and hastens the healing process [29]. *Abhyanga* [30] (massage) followed with *Shastika shali pinda sweda* (bolus fomentation of boiled rice grains tied in piece of cloth) helps in relieving muscle stiffness, heaviness and improves muscle strength [30,31]. Rhythmically applied pressure using hands in a systematic fashion helps in mechanical stimulation of the soft tissues, thus improving range of motion, relaxation of muscles and reduce pain [32]. *Ayurveda* classics have indicated *balarishta* (Table 1) specially in *vata vyadhi* (nervous disorders) which enhances *Bala* (strength of tissues) and *Agni* (Digestion) [33]. *Bala* (*Sida cordifolia* L.) and *Ashwagandha* (*Withania somnifera* L.) are the active ingredients of the formulation which provides nutrition to the tissues and strengthens the musculoskeletal system, there by increases endurance of sports person and helps in speedy recovery [34]. Range of motion in relation to the shoulder joint and elbow joint results were insignificant which may be due to less samples (10% each), Joint complexity, severity of the injury as CT and MRI scan were not performed to assess the injury level, short treatment period.

Evaluation of complementary and alternative medicine interventions needs a whole system research (WSR) approach which essentially focuses on single patient and provides individualised treatment care. Sports injuries are complex, which requires quantitative and qualitative research methods to analyse the outcome so WSR provides a multidimensional approach towards healing. Future research works on both preventive and curative aspects of sports injuries is essential in the path of WSR for providing customised care for sports person [35].

## 5. Conclusion

Integrated treatment approach for common sports injuries has given significant results in the parameters like pain, swelling, loss of function, tenderness, local temperature, manual muscle testing and range of motions of wrist, knee and ankle joint. Phase wise management by integrated protocol is effective in the management of common sports injuries.

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## Conflict of interest

None.

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