CHAPTER II

REVIEW OF RELATED LITERATURE

The study of the relevant literature was an essential step to get a full picture of what has been done and stated by other researchers. The most relevant literature pertaining to the present study was collected through various sources and was presented here. The collected reviews have been classified into the following sub-sections.

1. Studies on Sports Injuries
2. Studies on Short Wave Diathermy
3. Studies on Ultrasound therapy
4. Studies on Wax Therapy and Massage

2.1 STUDIES ON TREATMENT OF SPORTS INJURIES

Jerome Fan and Karen Woolfrey (2006) determined whether triage nurses ordering x-rays according to the Ottawa Ankle Rules (OAR) before physician evaluation decrease the length of stay for patients visiting an urgent care department. From July to September 2004, a randomized controlled trial of consecutive patients with ankle/foot twisting injuries arriving at an urgent care department took place. Patients aged 18 years or more with a \( \leq \)7-day-old injury were included. They were excluded if there were neurovascular deficits, limb
deformities, open fractures, or non-isolated ankle/foot injuries. Patients were randomly allocated to an x-ray-ordering clinical pathway (intervention) or standard departmental care (control). Those assigned to the intervention group had triage nurses apply the OAR and send those with positive OAR for x-rays before physician evaluation. Physicians were blinded to negative OAR nurse assessments. Investigators were blinded to group allocation. The primary outcome was the total median length of stay (TLOS). The secondary outcomes were patient satisfaction (5-point ordinal scale) and the proportion willing to return (WOR) for future care. Mann-Whitney test was used to analyze the TLOS and satisfaction rating differences between groups. Two-proportion t-test was used to analyze the WOR outcome. This study had 80% power to detect an effect size of 25 minutes. 167 patients were eligible; 130 patients consented and were enrolled. 3 patients were then excluded, 3 were lost to follow-up, and 1 left without being seen. The intervention and control groups had median TLOS of 73.0 min and 79.7 min, respectively. There was a non-significant time difference of −6.7 min (95% CI: −20.9 to 7.4 min) between groups. There were no differences in patient satisfaction ratings (0; 95% CI: −1 to 0) or WOR (3.8%; 95% CI: −3.3% to 11.0%). Triage nurses using OAR and ordering x-rays before physician evaluation for twisting ankle/foot injuries do not decrease the length of stay in an urgent care department.

Gregory et.al. (2006) studied the effects of powered ankle-foot orthoses on joint kinematics and muscle activation during walking in individuals with
incomplete spinal cord injury. It was found mechanical assistance from powered ankle-foot orthoses improved ankle push-off kinematics without substantially reducing muscle activation during walking in subjects with incomplete spinal cord injury. These results suggest that robotic plantar flexion assistance could be used during gait rehabilitation without promoting patient passivity.

McGriff-Lee (2003) documented that participation in sports-related activities increases the risk for acute injury to soft tissues. In adults, the sites most often affected include the ankle, knee, and wrist joint structures, along with the muscles of the back and extremities. The subsequent inflammatory response to tissue damage results in pain and swelling, which limits mobility. A thorough patient assessment is required for accurate diagnosis and provides a guide for appropriate treatment. Initial management is based on the principles of basic first aid: rest, ice, compression, and elevation. Pharmacological therapy can also be used to achieve pain relief and improve mobility. There are few well-controlled studies addressing the pharmacotherapy of acute soft tissue injury, but clinical experience with nonsteroidal anti-inflammatory drugs is extensive. Both traditional and nontraditional therapeutic approaches are discussed. To conduct a detailed analysis of ankle sprains sustained in English professional football over two competitive seasons. Club medical staff at 91 professional football clubs annotated player injuries. A specific injury audit questionnaire was used together with a weekly form that documented each club’s current injury status.
Woods, et.al. (2003) completed injury records for the two competitive seasons were obtained from 87% and 76% of the participating clubs. Ankle ligament sprains accounted for 11% of the total injuries over the two seasons, with over three quarters (77%) of sprains involving the lateral ligament complex. A total of 12,138 days and 2033 matches were missed because of ankle sprains. More sprains were caused by contact mechanisms than non-contact mechanisms (59% v 39%) except in goalkeepers who sustained more non-contact sprains (21% v 79%, p<0.01). Ankle sprains were most often observed during tackles (54%). More ankle sprains were sustained in matches than in training (66% v 33%), with nearly half (48%) observed during the last third of each half of matches. A total of 44% of sprains occurred during the first three months of the season. A high number of players (32%) who sustained ankle sprains were wearing some form of external support. The recurrence rate for ankle sprains was 9%. Ankle ligament sprains are common in football usually involving the lateral ligament complex. The high rate of occurrence and recurrence indicates that prevention is of paramount importance.

The efficiency of CT versus X-ray study was evaluated. Specific guidelines are given to make spital CT. CT is shown to be of the most informative value in the diagnosis of lesions of the tibial plateau, undisplaced fractures of the internal malleolus, small marginal comminuted fractures, and lesions of the distal tibiofibular syndesmosis. There is evidence for that CT plays a dominant role in
the diagnosis of lesions of the talus and calcaneus. Emphasis is laid on the great value of secondary multi- and three-dimensional image reconstructions.

Wall (1999) studied the application of Ottawa Ankle Rules to evaluate Ankle and Foot injuries by Army Nurse Practitioners. The exploration of the utilization of the Ottawa Ankle Rules by Army Nurse Practitioners was accomplished in this study through a quantitative, descriptive research methodology. The population included all active duty Army Adult, Family, and Women's Health Nurse Practitioners. Experts reviewed the tool. The total population of 105 was included in the mailing of the survey, and 90 surveys were returned. Data was analyzed using the comparative method, and reported in order to describe the population, and the tendencies of that population to use the Ottawa Ankle Rules.

Carmines, et al. (1998) made a gait analysis to compare the ground reaction forces, ankle and foot rotations in the sagittal plane, and the center of pressure pattern beneath the right feet of seven normal subjects walking barefoot, with and without their right ankles taped in the neutral position. Instrumentation included a force plate, ankle goniometer, and two accelerometers mounted on top of the foot. The ground reaction forces showed no changes between the same ankle, taped and untaped. Taping served to reduce the range of ankle rotations in the sagittal plane by approximately 20%, with a subsequent increase in the rotation about the metatarsal heads during heel-up. Heel-up occurred earlier in
stance when the ankle was taped than with no taping. The vertical force graph was integrated over time when the center of pressure was located beneath the heel and the ball, resulting in two impulse measurements. The heel impulse decreased for each of the 7 subjects and 6 of the 7 subjects displayed an increase in the ball impulse due to taping, indicating that taping served to shift the load-time history away from the heel and toward the ball. The results of this study may apply to fused ankle patients, who may suffer forefoot abnormalities subsequent to ankle fusion surgery.

Kirkpatrick et.al. (1998) undertook a prospective study to determine the type and distribution of foot and ankle snowboarding injuries. Reports of 3213 snowboarding injuries were collected from 12 Colorado ski resorts between 1988 and 1995. Of these, 491 (15.3%) were ankle injuries and 58 (1.8%) were foot injuries. Ankle injuries included 216 (44%) fractures and 255 (52%) sprains. Thirty-three (57%) of the foot injuries were fractures and 16 (28%) were sprains. The remaining injuries were soft tissue injuries, contusions, or abrasions. There was no significant correlation between boot type (soft, hybrid, or hard) and overall foot or ankle injury rate. There were significantly fewer ankle sprains in patients wearing hybrid boots and fewer fractures of the lateral process of the talus in patients wearing soft boots. An unexpectedly high number of fractures of the lateral process of the talus were noted. These 74 fractures represented 2.3% of all snowboarding injuries, 15% of all ankle injuries, and 34% of the ankle fractures.
Many of these fractures are not visible on plain radiographs and require computed tomography imaging to be diagnosed. Diagnosis of this fracture pattern is paramount; the physician should be very suspicious of anterolateral ankle pain in the snowboarder, where subtle fractures that may require surgical intervention can be confused with anterior talofibular ligament sprains.

Kaikkonen et.al. (1996) made a prospective study was performed to compare surgical treatment (primary repair plus early controlled mobilization) to functional treatment (early controlled mobilization alone) in severe (Grade III) lateral ligament injuries of the ankle. Thirty surgically treated patients were compared with 30 age, height, weight, gender, and sporting activity matched, functionally treated similar patients. In both treatment groups, all but 1 patient had a stable ankle at 9 months. Compared with the functional group, the range of motion of the ankle joint was restricted in the surgical treatment group at 6 weeks but did not normalize during the followup. The functional group showed no restrictions. A specific scoring scale developed for subjective and functional followup evaluation of in injured ankle also was used as an outcome criterion. Nine months after the injury, excellent or good scores were achieved in 87% of the functionally treated patients and 60% of the surgically treated patients, respectively. The results of this study indicated that early mobilization gives better results than surgery plus mobilization in the treatment of the complete tears of the lateral ligaments of the ankle.
Wester, et.al. (1996) reported that ankle sprains are often complicated by functional instability and repeated sprains. Rehabilitation with wobble boards in patients with functional instability has been tested, and significant improvement has been found compared to no training. The aim of this study was to investigate whether the number of patients with residual symptoms following ankle sprains could be reduced by training on a wobble board during 12-week recovery period. In addition, the influence of training in the time course reduction of edema was investigated. The Researcher performed a prospective study including 61 patients, all active in sports for more than 2 hours a week with primary ankle sprains. The effect of a 12-week training program with wobble board was compared with no training. Forty-eight patients completed the study. In the follow-up period (mean X = 230 days), we found significantly fewer recurrent sprains, and significantly fewer patients in the training group had functional instability of the ankle compared with the no training group. There were no differences in the two groups in the time which elapsed before patients were painless at walking, during running, or at sports. Volumetric measurements revealed no difference in the speed of reduction of hematoma and edema of the ankle and foot between the two groups. It was concluded that training on a wobble board early after primary stage 2 ankle sprains is effective in reducing residual symptoms following this lesion and that training does not seem to affect the time.
Stiell, et al. (1993) validated and refine previously derived clinical decision rules that aid the efficient use of radiography in acute ankle injuries. Survey prospectively administered in two stages: validation and refinement of the original rules (first stage) and validation of the refined rules (second stage) emergency departments of two university hospitals. Convenience sample of adults with acute ankle injuries: 1032 of 1130 eligible patients in the first stage and 453 of 530 eligible patients in the second stage. Attending emergency physicians assessed each patient for standardized clinical variables and classified the need for radiography according to the original (first stage) and the refined (second stage) decision rules. The decision rules were assessed for their ability to correctly identify the criterion standard of fractures on ankle and foot radiographic series. The original decision rules were refined by univariate and recursive partitioning analyses. In the first stage, the original decision rules were found to have sensitivities of 1.0 (95% confidence interval [CI], 0.97 to 1.0) for detecting 121 malleolar zone fractures, and 0.98 (95% CI, 0.88 to 1.0) for detecting 49 midfoot zone fractures. For interpretation of the rules in 116 patients, kappa values were 0.56 for the ankle series rule and 0.69 for the foot series rule. Recursive partitioning of 20 predictor variables yielded refined decision rules for ankle and foot radiographic series. In the second stage, the refined rules proved to have sensitivities of 1.0 (95% CI, 0.93 to 1.0) for 50 malleolar zone fractures, and 1.0 (95% CI, 0.83 to 1.0) for 19 midfoot zone fractures. The potential reduction in
Radiography is estimated to be 34% for the ankle series and 30% for the foot series. The probability of fracture, if the corresponding decision rule were "negative," is estimated to be 0% (95% CI, 0% to 0.8%) in the ankle series, and 0% (95% CI, 0% to 0.4%) in the foot series. Refinement and validation have shown the Ottawa ankle rules to be 100% sensitive for fractures, to be reliable, and to have the potential to allow physicians to safely reduce the number of radiographs ordered in patients with ankle injuries by one third. Field trials will assess the feasibility of implementing these rules into clinical practice.

Konradsen, et al. (1991) selected eighty patients with grade III lateral ligament ruptures and were treated either with total immobilization in a walking plaster cast or early mobilization in a stabilizing orthosis. The criterion for entrance was a taller tilt of more than 9 degrees and an anterior translation of more than 10 mm at stress radiography, a previously stable ankle, and a contralateral ankle showing normal stress radiographic values. Ninety-one percent of the patients were evaluated at 7 weeks, 3 months, and 1 year post injury. While functionally treated patients reached normal mobility and resumed work and sports earlier than immobilized patients there were no differences between the treatment groups in ankle stability or symptoms during activity after 1 year. Ninety-five percent of the ankles in either group were mechanically stable after treatment. Residual symptoms were present 1 year post injury in 13% of the functionally treated ankles and in 9% of the cast-mobilized ankles. In lateral ankle
ligament ruptures causing gross mechanical instability early mobilization results in a better early functional result; however, at 1 year postinjury there was no statistically significant difference in outcome as compared to cast-immobilized ankles.

Colville, et.al. (1990) measured strain in the lateral ligaments of 10 human cadaver ankles while moving the ankle joint and applying stress in a variety of ways. They studied the anterior talofibular, calcaneofibular, posterior talofibular, anterior tibiofibular, and posterior tibiofibular ligaments. Strain measurements in the ligaments were recorded continuously while the ankle was moved from dorsiflexion into plantar flexion. They then repeated measurements while applying inversion, eversion, internal rotation, and external rotation forces. Strain in the anterior talofibular ligament increased when the ankle was moved into greater degrees of plantar flexion, internal rotation, and inversion. Strain in the calcaneofibular ligament increased as the talus was dorsiflexed and inverted. These findings support the concept that the anterior talofibular and calcaneofibular ligaments function together at all positions of ankle flexion to provide lateral ankle stability. They measured maximum strain in the posterior talofibular ligament when the ankle was dorsiflexed and externally rotated. The strain in the anterior and posterior tibiofibular ligaments increased when the ankle was dorsiflexed. External rotation increased strain in the anterior tibiofibular ligament and decreased strain in the posterior tibiofibular ligament. Based upon
strain measurements in the lateral ankle ligaments in various ankle joint positions, They believe the anterior talofibular ligament is most likely to tear if the ankle is inverted in plantar flexion and internally rotated. Theoretically, the calcaneofibular ligament tears primarily in inversion if the ankle is dorsiflexed; the anterior tibiofibular ligament tears in dorsiflexion, especially if combined with external rotation; and the posterior tibiofibular ligament tears with extreme dorsiflexion.

Ahouvuo J, et.al. (1988) studied the diagnostic accuracy of inversion and anterior stress radiography in rupture of the lateral ligaments of the ankle joint was assessed in 56 patients undergoing surgery. In inversion stress radiography, 58 per cent of the patients with confirmed rupture of the lateral ligaments of the ankle had a talar tilt of 10 degrees or more, allowing a predictive value of a positive test of 94 per cent. In anterior stress radiography, 53 per cent of the patients had a posterior tibiotalar distance of 9 mm or more, allowing a predictive value of a positive test of 81 per cent. In measurements of talar tilt and anterior displacement of the talus values higher than normal in the injured ankle may be a sign of a rupture of the lateral ligament.

2.2 STUDIES ON SHORT WAVE DIATHERMY TREATMENT FOR SOFT TISSUE INJURIES
Cetin et.al. (2008) investigated the therapeutic effects of physical agents administered before isokinetic exercise in women with knee osteoarthritis. One hundred patients with bilateral knee osteoarthritis were randomized into five groups of 20 patients each: group 1 received short-wave diathermy + hot packs and isokinetic exercise; group 2 received transcutaneous electrical nerve stimulation + hot packs and isokinetic exercise; group 3 received ultrasound + hot packs and isokinetic exercise; group 4 received hot packs and isokinetic exercise; and group 5 served as controls and received only isokinetic exercise. Pain and disability index scores were significantly reduced in each group. Patients in the study groups had significantly greater reductions in their visual analog scale scores and scores on the Lequesne index than did patients in the control group (group 5). They also showed greater increases than did controls in muscular strength at all angular velocities. In most parameters, improvements were greatest in groups 1 and 2 compared with groups 3 and 4. Using physical agents before isokinetic exercises in women with knee osteoarthritis leads to augmented exercise performance, reduced pain, and improved function. Hot pack with a transcutaneous electrical nerve stimulator or short-wave diathermy has the best outcome.

Muratore, et.al. (2008) documented that small tears in tendons are a common occurrence in athletes and others involved in strenuous physical activity. Natural healing in damaged tendons can result in disordered regrowth of the
underlying collagen matrix of the tendon. These disordered regions are weaker than surrounding ordered regions of normal tendon and are prone to re-injury. Multiple cycles of injury and repair can lead to chronic tendinosis. Current treatment options either are invasive or are relatively ineffective in tendinosis without calcifications. High-intensity focused ultrasound (HIFU) has the potential to treat tendinosis noninvasively. HIFU ablation of tendons is based on a currently-used surgical analog, viz., needle tenotomy. This study tested the ability of HIFU beams to ablate bovine tendons ex vivo. Two ex vivo animal models were employed: a bare bovine Achilles tendon (deep digital flexor) on an acoustically absorbent rubber pad, and a layered model (chicken breast proximal, bovine Achilles tendon central and a glass plate distal to the transducer). The bare-tendon model enables examination of lesion formation under simple, ideal conditions; the layered model enables detection of possible damage to intervening soft tissue and consideration of the possibly confounding effects of distal bone. In both models, the tissues were degassed in normal phosphate-buffered saline. The bare tendon was brought to 23 degrees C or 37 degrees C before insonification; the layered model was brought to 37 degrees C before insonification. The annular array therapy transducer had an outer diameter of 33 mm, a focal length of 35 mm and a 14-mm diameter central hole to admit a confocal diagnostic transducer. The therapy transducer was excited with a continuous sinusoidal wave at 5.25 MHz to produce nominal in situ intensities
from 0.23-2.6 kW/cm\(^2\). Insonification times varied from 2-10 s. The focus was set over the range from the proximal tendon surface to 7 mm deep. The angle of incidence ranged from 0 degrees (normal to the tissue surface) to 15 degrees. After insonification, tendons were dissected and photographed, and the dimensions of the lesions were measured. Transmission electron micrographs were obtained from treated and untreated tissue regions. Insonification produced lesions that mimicked the shape of the focal region. When lesions were produced below the proximal tendon surface, no apparent damage to overlying soft tissue was apparent. The low intensities and short durations required for consistent lesion formation, and the relative insensitivity of ablation to small variations in the angle of incidence, highlight the potential of HIFU as a noninvasive treatment option for chronic tendonitis.

Giombini, et.al. (2007) searched the literature for relevant studies. Most of the published studies in these fields have used 434 and 915 microwave diathermy, as these wavelengths are most effective and found Hyperthermia induced by microwave diathermy into tissue can stimulate repair processes, increase drug activity, allow more efficient relief from pain, help in the removal of toxic wastes, increase tendon extensibility and reduce muscle and joint stiffness. Moreover, hyperthermia induces hyperemia, improves local tissue drainage, increases metabolic rate and induces alterations in the cell membrane. The biological mechanism that regulates the relationship between the
thermal dose and the healing process of soft tissues with low or high water content or with low or high blood perfusion is still under study. Microwavediathermy treatment at 434 and 915 MHz can be effective in the short-term management of musculo-skeletal injuries

Laufer et al. (2005) examined the effects of pulsed short-wave diathermy (PSWD), delivered at an intensity sufficient to induce a thermal sensation and at an athermal intensity, in comparison with a placebo short-wave diathermy treatment, on reported pain, stiffness and functional ability and on mobility performance of patients with osteoarthritis of the knee. A placebo-controlled double-blind trial with sequential allocation of patients to different treatment groups. One hundred and three consecutive patients, mean age 73.7 (+/-6.6) years with osteoarthritis of one or both knees for at least three months. All participants received three 20-min-long treatments per week for three weeks. One group received PSWD with mean power of 18 W (thermal effect), one group received PSWD with mean power of 1.8 W (athermal effect), and one group received sham short-wave diathermy treatment. Patients were assessed before the initial treatment, immediately following the last treatment, and at a three-month follow-up. The findings do not demonstrate pulsed short-wave diathermy, as it is utilized in clinical settings, to be effective in the treatment of osteoarthritis of the knee.
2.3 STUDIES ON ULTRASOUND THERAPY TREATMENT ON SOFT TISSUE INJURIES

Wolff, et.al. (2011) documented that possible effects of comorbidities and of different wound etiologies on the success of extracorporeal shock wave therapy (ESWT) of chronic soft tissue wounds were investigated. From September 2003 until February 2007, 282 patients, being previously treated unsuccessfully were enrolled. Treatment consisted of ESWT occurring at defined intervals. At each treatment session a wound bed score was recorded, also at initial presentation a detailed patient history and wound etiology. Observed comorbidities were pooled according to the chapters of the ICD-10 system. Two hundred fifty-eight patients were analyzed (91.49%) and underwent follow-up for a median of 31.8 months. Wound closure occurred in 191 patients (74.03%) by a median of two treatment sessions. No wound reappeared at the same location. A multivariate logistic regression model showed that pooled comorbidities and wound etiologies did not have a significant influence on success. Comorbidities and wound etiologies have surprisingly no significant influence on the success of ESWT.

Shanks , et.al. (2010) found that Ultrasound is suggested as one of the treatment options available for soft tissue musculoskeletal conditions of the lower limb and to this end, the objective was to review the literature and evaluate the
effectiveness of therapeutic ultrasound for musculoskeletal conditions of the lower limb. A search of the literature published between 1975 and February 2009 was carried out. All studies that fulfilled the inclusion criteria were quality assessed and scored using the Critical Appraisal Skills Programme (CASP) appraisal tool [1] for randomised controlled trials. Ten studies out of a possible fifteen were included in the review. Only one trial was considered to be high quality (score 16+), three medium quality trials (score 11-15) were identified and six trials were considered to be low or poor quality (score ≤10). None of the six placebo-controlled trials found any statistically significant differences between true and sham ultrasound therapy. This literature review found that there is currently no high quality evidence available to suggest that therapeutic ultrasound is effective for musculoskeletal conditions of the lower limb.

Beyer, et.al. (2010) reported that Muscle haematoma represents 10-25% of bleeds in patients with severe haemophilia. There is limited consensus on diagnostic or treatment strategies and little knowledge about the natural history of muscle haematoma and optimal treatment goals. The aim of this review was to perform a systematic description of the natural history of muscle haematoma in healthy athletes, focusing on diagnosis, classification and treatment options. Publications and educational textbooks on management of sports injuries were used as data source. Muscle haematomas occur following contusion, strain, or
laceration and can be categorized as mild, moderate, or severe. Muscle haematoma may be inter- or intramuscular. In healthy athletes, the healing process takes 20-40 days. Optimal diagnosis includes history, physical examination (inspection, palpation, active and passive range of motion (ROM) test, muscle length test, isometric strength test, biomechanical examination, full spinal examination, peripheral nerve test and slump test), ultrasound, MRI or CT. Treatment is conducted based on: (i) super-acute stage, control of the bleeding and minimizing the size of the haematoma; (ii) acute stage, restoration of pain-free ROM; (iii) subacute stage, functional rehabilitation; and (iv) gradual return to normal activity. Treatment and preventive strategies include RICE (rest, ice, compression and elevation), protected mobilization, stretching and strengthening exercises, manual therapy (articular, neural and soft tissue mobilization and massage), correction of movement dysfunction, functional rehabilitation and electro-therapeutic interventions. The study reviews the natural history of muscle haematoma and state-of-the-art diagnosis and treatment in healthy athletes. Results may be useful to optimize diagnosis and treatment of muscle haematoma in patients with haemophilia.

Hopper, et.al. (2010) documented that most muscle trauma more commonly involves the lower extremity, but injury to the chest wall, particularly the pectoralis major, is well recognized. Trauma to the upper limb muscle-tendon unit is preserved. Development of complications from muscle injury is also
discussed. This article systematically reviews the clinical features, pathogenesis, imaging findings, and management for upper limb and chest wall muscle injuries. Imaging modalities focus on magnetic resonance imaging and ultrasound, highlighting their advantages and disadvantages in specific situations.

Alexander et al. (2010) aimed to systematically and critically review available literature to ascertain whether beneficial effects of ultrasound were associated with certain shoulder pathologies or particular ultrasound treatment protocols. Five electronic databases were searched, and the included studies, identified through pair consensus, were randomized controlled trials (RCTs) that utilized ultrasound for soft tissue shoulder injury or pain. Eight studies included in this review (n=586 patients, median PEDro score=8.0/10) evaluated various parameters, including the duration of patients' symptoms (0-12 months), duty cycle (20% and 100%), intensity (0.1-2.0 W/cm²), treatment time per session (4.5-15.8 minutes), number of treatments (6-39), and total energy applied per treatment (181-8,152 J). Inconsistent outcome measures among studies precluded meta-analysis; however, 3 RCTs showed statistically significant benefits of ultrasound, 2 of which examined calcific tendinitis. Studies that showed beneficial effects of ultrasound typically had 4 times longer total exposure times and applied much greater ultrasound energy per session (average of 4,228 J) compared with studies that showed no benefit of ultrasound (average of 2,019 J). No studies that delivered < or = 720 J per session showed improvement in
treatment groups. Current research involving ultrasound treatment protocols that delivered low levels of ultrasound energy do not adequately address whether ultrasound can improve outcomes for shoulder disorders. Determining whether therapeutic ultrasound can affect soft tissue shoulder pathologies will require further research and systematic reviews that involve appropriate ultrasound treatment protocols.

Makhsous , et.al. (2008) documented that Differences in soft-tissue stiffness may provide for a quantitative assessment and detection technique for pressure ulcers or deep-tissue injury. An ultrasound indentation system may provide a relatively convenient, simple, and noninvasive method for quantitative measurement of changes in soft-tissue stiffness in vivo. The Tissue Ultrasound Palpation System (TUPS) was used to quantitatively measure changes in soft-tissue stiffness at different anatomical locations within and between able-bodied persons and individuals with chronic spinal cord injury (SCI). The stiffness of soft tissue was measured at the ischial tuberosity, greater trochanter, posterior midthigh, and biceps brachii. Additionally, soft-tissue thickness and soft-tissue deformation were also measured. Significant differences in soft-tissue stiffness were observed within the various anatomical locations tested, in both the able-bodied and SCI groups. Differences in soft-tissue stiffness were also observed between the 2 groups. Participants with SCI had significantly softer tissue in their buttock-thigh area. TUPS is a clinically
feasible technology that can reliably and effectively detect changes in soft-tissue stiffness. The study has provided a better understanding of the tissue mechanical response to external loading, specifically in the SCI population, suggesting the use of tissue stiffness as a parameter to detect and assess pressure-related soft-tissue injury

Watson. (2008) found that the use of therapeutic ultrasound as an element of physiotherapy practice is well established, but the nature of that practice has changed significantly over the last 20 years. This paper aims to review the rationale and range of applications for which this modality is employed in current practice. Whereas in the past, its primary use was as a thermal modality, it is argued that currently, it is the 'non-thermal' aspects of the intervention that are most commonly employed. The predominant use of therapeutic ultrasound is in relation to tissue repair and soft tissue lesion management, where the evidence would support its application in the inflammatory, proliferative and remodelling phases. The clinical outcomes appear to be dose dependent, and whilst this paper does not detail dose related clinical decision making, the broad issues are considered. The future possibilities for the use of the modality are reviewed, and although outside the immediate remit of this paper, the use of therapeutic ultrasound in fracture management is briefly considered.

Kovacevic , and Rodeo SA. (2008) used a sheep infraspinatus repair model to evaluate the effect of osteoinductive growth factors and BMP-12 on
tendon-to-bone healing. Magnetic resonance imaging and histology showed increased formation of new bone and fibrocartilage at the healing tendon attachment site in the treated animals, and biomechanical testing showed improved load-to-failure. Other techniques with potential to augment repair site biology include use of platelets isolated from autologous blood to deliver growth factors to a tendon repair site. Modalities that improve local vascularity, such as pulsed ultrasound, have the potential to augment rotator cuff healing. Important information about the biology of tendon healing can also be gained from studies of substances that inhibit healing, such as nicotine and antiinflammatory medications. Future approaches may include the use of stem cells and transcription factors to induce formation of the native tendon-bone insertion site after rotator cuff repair surgery.

Bleakley, et al. (2007) reported that cryotherapy (the application of ice for therapeutic purposes) is one of the most common treatment modalities employed in the immediate management of acute soft tissue injury. Despite its widespread clinical use, the precise physiological responses to therapeutic cooling have not been fully elucidated, and effective evidence-based treatment protocols are yet to be established. Intermittent ice applications are thought to exert a significant analgesic effect. This could facilitate earlier therapeutic exercise after injury, potentially allowing for a quicker return to activity. The primary aim of the forthcoming study is therefore to examine the safety and
effectiveness of combining intermittent ice applications with periods of therapeutic exercise in the first week after an acute ankle sprain. The study is a randomised controlled trial. 120 subjects with an acute grade I or grade II ankle sprain will be recruited from Accident & Emergency and a University based Sports Injury Clinic. Subjects will be randomised under strict double-blind conditions to either a standard cryotherapy (intermittent ice applications with compression) or cryokinetic treatment group (intermittent ice applications with compression and therapeutic exercise). After the first week, treatment will be standardised across groups. Assessor blinding will be maintained throughout the trial. Primary outcome will be function, assessed using the Lower Extremity Functional Scale (LEFS). Additional outcomes will include pain (10 cm Visual Analogue Scale), swelling (modified figure-of-eight method) and activity levels (activPAL trademark physical activity monitor, PAL Technologies, Glasgow, UK). Diagnostic Ultrasound (Episcan-1-200 high frequency ultrasound scanning system, Longport International Ltd, PA) will also be used to assess the degree of soft tissue injury. After baseline assessment subjects will be followed up at 1, 2, 3 & 4 weeks post injury. All data will be analysed using repeated measures analysis of co-variance (ANCOVA). This paper describes the rationale and design of a randomised controlled trial which will examine the effectiveness of two different cryotherapy protocols in the early management of acute ankle sprain.
McCarthy et al. (2006) evaluated the findings and diagnostic accuracy of ultrasound in antero-lateral ankle impingement (ALI) with clinical and arthroscopic correlation. Seventeen elite footballers with chronic ankle pain were referred for ultrasound with a clinical diagnosis of ALI (n = 8) or a control condition (n = 9; lateral mechanical instability, osteochondral defect, intra-articular bodies and osteoarthritis). Ultrasound examination included the antero-lateral gutter for abnormal synovial tissue (synovitic lesion), lateral ligament integrity, tibiotalar joint and osseous spurs of the distal tibia and talus. Ultrasound findings were correlated with subsequent arthroscopic appearance. Ultrasound examination detected a synovitic mass in the antero-lateral gutter in all 8 footballers with clinical ALI (100%) and in 2 patients with a control diagnosis (22%). Arthroscopic correlation of antero-lateral synovitis and fibrosis was present in all 10 cases (100%). The synovitic lesion was seen at ultrasound as a nodular soft tissue mass of mixed echogenicity within the antero-lateral gutter, which extruded anteriorly with manual compression of the distal fibula against the tibia. Increased blood supply was detected using power Doppler imaging in only 1 patient. The synovitic lesion measured >10 mm in its maximum dimension in 7 footballers with clinical ALI and <10 mm in the control group. Additional ultrasound findings in patients with abnormal antero-lateral synovial tissue included an anterior talofibular ligament injury in all patients (n = 10), a tibiotalar joint effusion (n = 6) and osseous spurs (n = 4). Antero-lateral
synovitic tissue was accurately identified at ultrasound in the absence of an effusion (n = 4). No synovitic lesion was detected at ultrasound or arthroscopy in the remaining 7 patients with a control diagnosis. Ultrasound is accurate in detecting synovitic lesions within the antero-lateral gutter, demonstrating associated ligamentous injuries and in differentiating soft tissue from osseous impingement. Synovitic lesions in two control patients suggest that abnormal antero-lateral soft tissue does not necessarily imply the presence of symptomatic ALI. Synovitic lesions in excess of 10 mm were associated with symptoms. Ultrasound will not demonstrate osteocartilaginous lesions or stress fractures and may overlook some loose bodies. Ultrasound findings together with clinical correlation can be used to direct arthroscopic examination and surgical debridement.

Giombini, et.al. (2006) tested the null hypothesis that there are no short-term differences after the use of hyperthermia, ultrasound, and exercises for tendinopathy of the supraspinatus tendon. The authors studied 37 athletes (29 men, 8 women; mean age, 26.7 +/- 5.8 years; range, 19-43 years) with supraspinatus tendinopathy who had had symptoms between 3 and 6 months. Subjects were randomly assigned to 3 groups. Group A (n = 14) received hyperthermia at 434 MHz. Group B (n = 12) received continuous ultrasound at 1 MHz at an intensity of 2.0 w/cm(2) 3 times a week. Group C (n = 11) undertook exercises, consisting of pendular swinging and stretching exercises 5 minutes
twice a day every day. All interventions were undertaken for 4 weeks. Subjects were evaluated at baseline, immediately on completion of treatment, and at 6 weeks after the end of the intervention using mean pain score for pain at night, during movement, and at rest on a visual analog scale; pain on resisted movement and painful arc on active abduction between 40 degrees and 120 degrees on a 4-point scale; and Constant score. Patients who received hyperthermia experienced significantly better pain relief than did patients receiving ultrasound or exercises: group A, 5.96 to 1.2 (P = .03); group B, 6.3 to 5.15 (P = .10); group C, 6.1 to 4.9 (P = .09). Hyperthermia at 434 MHz appears safe and effective in the short term for the management of supraspinatus tendinopathy.

Messiou , et.al. (2006) described the use of MR imaging and efficacy of ultrasound-guided steroid injection in the diagnosis and management of athletes with clinical posteromedial impingement of the ankle. A retrospective analysis of imaging findings on MR was undertaken in nine elite athletes with clinical posteromedial ankle impingement. MR studies from six professional athletes with posterolateral pain were also reviewed as an imaging control group. The two reviewing radiologists were blinded to the clinical details and the proportion of control and study subjects. The nine study athletes also underwent diagnostic ultrasound and ultrasound-guided injection of steroid and anaesthetic into the posteromedial capsular abnormality. Follow-up was by telephone interview. Posteromedial capsular thickening was seen only in athletes with
posteromedial impingement (7/9). Posteromedial synovitis was present in all athletes with posteromedial impingement; however, posterior and posterolateral synovitis was also seen in these athletes. Mild posteromedial synovitis was present in two control athletes. Ultrasound identified abnormal posteromedial soft tissue thickening deep to tibialis posterior between the medial malleolus and talus in all nine athletes. After injection all athletes returned to their previous level of sport, with eight of the nine not experiencing any residual or recurrent symptoms. If MR imaging excludes significant coexistent abnormality, ultrasound can localize posteromedial soft tissue abnormality and guide injection therapy, allowing return to athletic activity without surgical intervention.

Tibesku, and Pässler. (2005) defined jumper’s knee as painful chronic overuse injury of the extensor mechanism of the knee joint. The disease has a high incidence in jumping sports and depends on training frequency and level of performance. Its natural course is protracted, repetitive, and often bilaterally occurring. Its etiology is a chronic overload of the knee extensor mechanism which is triggered by jumping sports (volleyball, basketball etc.) as well as different intrinsic (ligamentous laxity, Q-angle, patella height, tenderness, pattern of force development) and extrinsic dispositions (frequency of training, level of performance, hardness of underground). The place of pathology most often is the osteo-tendinous transition zone of the proximal patellar tendon. Histologic
evaluation of the tendon showed that the disease is rather degenerative than inflammatory. The diagnosis is primarily based on the typical sports history, physical examination, and ultrasound. MRI is helpful in operation planning. Plain radiography, CT, and bone scans are used to rule out differential diagnoses. Therapy should be chosen according to the stage of the disease and usually starts with a non-surgical approach. This includes rest from sports activities, immobilisation, non-steroid antiphlogistics, para-tendinous cortisone injections, massage, electric therapy, ultrasound and extracorporal shock waves. Afterwards an increase of activities is begun (moderate training, adequate warm-up, ice cooling after activity, muscle stretching, eccentric strengthening of the quadriceps). Patella straps and soft insoles are used as prevention. Up to 42% of patients need surgical therapy after failure of long-lasting non-surgical measures, carried out either open or arthroscopically. Surgical principles include excision of the para-tendon, excision of the degenerative tissue, resection of the lower patella pole, and longitudinal incisions into the tendon. Most patients are pain-free after surgery but return to sports only at a lower level.

Sofka, and Adler. (2002) documented that both chronic as well as acute foot and ankle pain are common indications for visits to general practitioners, rheumatologists, and orthopedic surgeons. The causes for foot and ankle pain are varied and can include osseous pathology (fractures), yet the far greater majority are secondary to soft-tissue injuries and inflammation. Regional corticosteroid injections,
traditionally performed using anatomic landmarks, can be inaccurate and miss intended targets. The use of ultrasound for guidance for interventional radiologic procedures is well known, including guidance for vascular as well as visceral interventions. Using sonography to guide for interventions in the musculoskeletal system, specifically the foot and ankle, yields accurate placement of the needle tip and subsequent anesthetic/steroid injection as well as diagnostic aspiration of tendon sheaths, joint spaces, and bursae. Speed . (2001) reported that therapeutic ultrasound is one of the most common treatments used in the management of soft tissue lesions, which constitute the majority of rheumatic complaints. Although many laboratory-based research studies have demonstrated a number of physiological effects of ultrasound upon living tissue, there is remarkably little evidence for benefit in the treatment of soft tissue injuries. This may be related to several confounding factors, including technical variables, the complexity and variety of underlying pathologies in soft tissue lesions, methodological limitations of clinical studies, or true lack of effect. In this review the scientific basis for the use of therapeutic ultrasound in soft tissue lesions and the existing evidence relating to its clinical effect are detailed.

2.4 STUDIES ON WAX BATH AND MASSAGE FOR SOFT TISSUE INJURIES

Myrer et.al. (2011) compared treating patients with symptomatic hand osteoarthritis (OA) with paraffin baths only (PO) (100% wax) or paraffin baths
80% wax with 20% topical analgesic (PTA). Subjects met criteria of the American College of Rheumatology for classifying symptomatic hand OA and had a Dreiser's index score >5 points. Current and average pain at rest and with movement was assessed with visual analogue scales. Hand function was assessed by the functional index for hand OA (FIHOA). Both groups had a significant reduction in their 'current' pain 15 min after the first and twelfth treatments compared to pre-treatment but there was no difference between groups (t = 0.10, p > 0.05). The PTA group had greater improvement over the 12 treatment sessions for their pain at rest (t = 2.92, p < 0.05) and with movement (t = 4.73, p < 0.05) than the PO group. The PTA group also showed greater improvement in their FIHOA following 12 treatments than the PO group (t = 3.52, p < 0.05). Our results indicate that the addition of a topical analgesic to paraffin produced significantly greater pain relief at rest and during movement than paraffin baths alone after 12 treatments. Additionally, the PTA group experienced greater improved hand function.

Skouras, et.al. (2011) reported that insufficient recovery after peripheral nerve injury has been attributed to (i) poor pathfinding of regrowing axons, (ii) excessive collateral axonal branching at the lesion site and (iii) polyneuronal innervation of the neuromuscular junctions (NMJ). The facial nerve transection model has been used initially to measure restoration of function after varying therapies and to examine the mechanisms underlying their effects. Since it is very
difficult to control the navigation of several thousand axons, efforts concentrated on collateral branching and NMJ-polyinnervation. Treatment with antibodies against trophic factors to combat branching improved the precision of reinnervation, but had no positive effects on functional recovery. This suggested that polyneuronal reinnervation--rather than collateral branching--may be the critical limiting factor. The former could be reduced by pharmacological agents known to perturb microtubule assembly and was followed by recovery of function. Because muscle polyinnervation is activity-dependent and can be manipulated, attempts to design a clinically feasible therapy were performed by electrical stimulation or by soft tissue massage. Electrical stimulation applied to the transected facial nerve or to paralysed facial muscles did not improve vibrissal motor performance and failed to diminish polyinnervation. In contrast, gentle stroking of the paralysed muscles (vibrissal, orbicularis oculi, tongue musculature) resulted in full recovery of function. This manual stimulation was also effective after hypoglossal-facial nerve suture and after interpositional nerve grafting, but not after surgical reconstruction of the median nerve. All these findings raise hopes that clinically feasible and effective therapies could be soon designed and tested.

Chen, et.al. (2011) documented that bloodletting therapy is one of the typical treatment modes of traditional Chinese medicine, and acute soft tissue injury (ASTI) is one of the most common indications for
acupuncture therapeutics. In this paper, the current situation of treatments and pathological mechanisms of ASTIs, the existing problems of bloodletting therapy in the treatment of ASTIs and the study strategies are systematically analyzed, indicating that bloodletting therapy is significantly effective in the treatment of ASTIs. Breakthroughs in the treatment of ASTIs will be achieved with the application of bloodletting therapy both in clinical practice and experimental research.

Best, et al. (2008) documented that Sport massage, a manual therapy for muscle and soft tissue pain and weakness, is a popular and widely used modality for recovery after intense exercise. Our objective is to determine the effectiveness of sport massage for improving recovery after strenuous exercise. We searched MEDLINE, EMBASE, and CINAHL using all current and historical names for sport massage. Reference sections of included articles were scanned to identify additional relevant articles. Study inclusion criteria required that subjects (1) were humans, (2) performed strenuous exercise, (3) received massage, and (4) were assessed for muscle recovery and performance. Ultimately, 27 studies met inclusion criteria. Eligible studies were reviewed, and data were extracted by the senior author (TMB). The main outcomes extracted were type and timing of massage and outcome measures studied. Data from 17 case series revealed inconsistent results. Most studies evaluating post-exercise function suggest that massage is not effective, whereas studies that also evaluated the symptoms of
DOMS did show some benefit. Data from 10 randomized controlled trials (RCTs) do, however, provide moderate evidence for the efficacy of massage therapy. The search identified no trend between type and timing of massage and any specific outcome measures investigated. Case series provide little support for the use of massage to aid muscle recovery or performance after intense exercise. In contrast, RCTs provide moderate data supporting its use to facilitate recovery from repetitive muscular contractions. Further investigation using standardized protocols measuring similar outcome variables is necessary to more conclusively determine the efficacy of sport massage and the optimal strategy for its implementation to enhance recovery following intense exercise.

Brummitt. (2008) Massage is a popular treatment choice of athletes, coaches, and sports physical therapists. Despite its purported benefits and frequent use, evidence demonstrating its efficacy is scarce. To identify current literature relating to sports massage and its role in effecting an athlete's psychological readiness, in enhancing sports performance, in recovery from exercise and competition, and in the treatment of sports related musculoskeletal injuries. Electronic databases were used to identify papers relevant to this review. The following keywords were searched: massage, sports injuries, athletic injuries, physical therapy, rehabilitation, delayed onset muscle soreness, sports psychology, sports performance, sports massage, sports recovery, soft tissue mobilization, deep transverse friction massage, pre-event,
and post exercise. Research studies pertaining to the following general categories were identified and reviewed: pre-event (physiological and psychological variables), sports performance, recovery, and rehabilitation. Despite the fact clinical research has been performed, a poor appreciation exists for the appropriate clinical use of sports massage. Additional studies examining the physiological and psychological effects of sports massage are necessary in order to assist the sports physical therapist in developing and implementing clinically significant evidence based programs or treatments.

Mancuso et.al. (2009) investigated whether the use of paraffin and active hand exercises would improve activity and participation in persons with scleroderma. In this series of three single case studies, participants used paraffin and performed active hand exercises daily for eight weeks. To assess hand function, measures of body function/structure and activity/participation were taken at baseline, at one month and at two months after intervention. All participants experienced clinically significant improvements in both body function/structure measurements of hand function and in their ability to participate in activities. Significant improvements were found more frequently on body function/structure measures than activity/participation measures. This preliminary study lends support in favor of using paraffin and hand exercises as a treatment to improve hand function related to participation in daily activities in
persons with scleroderma. Further research with a larger sample and increased variable control is needed.

van den Dolder, and Roberts. (2003) investigated the effects of soft tissue massage on range of motion, reported pain and reported function in patients with shoulder pain. Twenty-nine patients referred to physiotherapy for shoulder pain were randomly assigned to a treatment group that received six treatments of soft tissue massage around the shoulder (n = 15) or to a control group that received no treatment while on the waiting list for two weeks (n = 14). Measurements were taken both before and after the experimental period by a blinded assessor. Active range of motion was measured for flexion, abduction and hand-behind-back movements. Pain was assessed with the Short Form McGill Pain Questionnaire (SFMPQ) and functional ability was assessed with the Patient Specific Functional Disability Measure (PSFDM). The treatment group showed significant improvements in range of motion compared with the control group for abduction (mean 42.2 degrees, 95% CI 24.1 to 60.4 degrees), flexion (mean 22.6 degrees, 95% CI 12.4 to 32.8 degrees) and hand-behind-back (mean 11.0 cm improvement, 95% CI 6.3 to 15.6 cm). Massage reduced pain as reported on the descriptive section of the SFMPQ by a mean of 4.9 points (95% CI 2.5 to 7.2 points) and on the visual analogue scale by an average of 26.5 mm (95% CI 5.3 to 47.6 mm), and it improved reported function on the PSFDM by a mean of 8.6 points (95% CI 4.9 to 12.3 points). We conclude that soft tissue massage around
the shoulder is effective in improving range of motion, pain and function in patients with shoulder pain. The mechanisms behind these effects remain unclear.

Brosseau, et al. (2002) reported that Deep transverse friction massage (DTFM) is one of several physiotherapy interventions suggested for the management of pain due to iliotibial band friction syndrome (ITBFS). OBJECTIVES: To assess the effectiveness of DTFM for treating ITBFS observed in runners. SEARCH STRATEGY: We searched the Medline, Embase, Healthstar, Sports Discus, CINAHL, the Cochrane Controlled Trials Register, PEDro, the specialized registry of the Cochrane musculoskeletal group and the Cochrane field of Physical and Related Therapies up to the end of December 2000, using the sensitive search strategy developed by the Cochrane Collaboration. The search was complemented with bibliography searching of the reference list of the trials retrieved from the electronic search. Key experts in the area were contacted for further published and unpublished articles. All randomized controlled trials (RCTs) and controlled clinical trials (CCTs) comparing therapeutic ultrasound against placebo or another active intervention in patients with patellofemoral pain syndrome were selected. Two reviewers determined the studies to be included based on inclusion and exclusion criteria (LB, VR). Data were independently abstracted by two reviewers (VR, LB), and checked by a third reviewer (BS) using a pre-developed form of the Cochrane Musculoskeletal Group. The same two reviewers, using a validated scale,
assessed the methodological quality of the RCTs and CCTs independently. Iliotibial band friction syndrome outcome measures were extracted from the publications. The pooled analysis was performed using weighted mean differences (WMDs) for pain relief as described as 1) daily pain; 2) pain while running and 3) percentage of maximum pain when running. A chi-square test was used to assess heterogeneity among trials. Fixed effects models were used throughout and random effects for outcomes showing heterogeneity. One RCT, including 17 patients with ITBFS was included. The experimental group (DTFM combined to rest, stretching exercises, cryotherapy and therapeutic ultrasound) (n=9) was compared to the control group (rest, stretching exercises, cryotherapy and therapeutic ultrasound only) (n=8). This trial showed no statistical difference in the three types of pain relief measured after four consecutive sessions of DTFM combined with other physiotherapy modalities for runners. Despite lack of statistical significance, there was a clinically important relative percentage difference in pain while running of 22%. DTFM combined with other physiotherapy modalities did not show consistent benefit over control of pain for runners experiencing ITBFS. These conclusions are limited by the low methodological quality of the one small sample size trial (n=17) included. No conclusions can be drawn about the use or non use of DTFM for the treatment of ITBFS. Future trials, utilizing appropriate methods and adequate sample sizes are
needed before conclusions can be drawn regarding the effect of massage on iliobibial band friction syndrome.

Fritschy, and de Gautard. (1988) selected twenty-five patients, aged between 15 and 45 years old, who were athletically active, presented with jumper's knee (patellar tendinitis). By use of ultrasonographic examination, new and precise information was obtained that benefited the diagnosis, choice of treatment, and monitoring of the evolution of jumper's knee in our patients. In 18 of the 25 patients, only 1 knee was affected; in 7 of the patients, both knees were affected, thus making a total of 32 painful tendons. These 25 patients were compared with a control group of 15 healthy, athletically active subjects between the ages of 25 and 35 years old. In all of the 32 painful tendons, ultrasonographic anomalies were observed: thickening or swelling of the tendon (15 knees) appeared in acute cases; a heterogeneous structure of the tendon (24 knees); and thickening and irregularities of the tendinous envelope (8 knees). The 15 acute patients all responded to classic conservative treatment including physical therapy and electrotherapy. Four of the remaining 10 patients were treated successfully with various conservative treatments, including deep transverse friction massage with ice. The other six patients were treated surgically, with tenolysis and "carding" of the patellar tendon. In one patient, this procedure failed, and 12 months later a second operation was performed, in which the distal pole of the patella was resected and the patellar tendon reinserted into bone.
Recovery was uneventful. Now, at least 2 years after treatment, all of the patients consider themselves healed.

Eretskaia et.al. (1975) 178 patients with various ligamental injuries were treated according to the technique elaborated at the Institute. To restore ligaments preserved tendon homografts from the long fibular tendon with a remained terminal bone fragment were employed. The techniques of Gay-Growth-Smith and Sitenko underlie the methods of tendinoplasty applied. Following the operation therapeutic exercises, using water basin, massage, mechanotherapy and different kinds of physical therapy were employed differentially. Good results were obtained in a vast majority of patients (91.6%).

2.7 SUMMARY OF THE LITERATURE

From the compilation of related literature, it was understood that only few studies have investigated about the treatment of soft wave diathermy for soft tissue sports injuries and there was little effort to specifically consider the injuries of basketball and volleyball players. The reviews proved that ultrasound therapy is widely used to treat soft tissue injuries however, there is further scope for research to find out effect of ultrasound therapy in treating volleyball and basketball players’ soft tissue injuries. Though massage is widely used for sportsmen prior to and after the competition, scientific researches are still required to find out the effects of wax therapy and massage on soft tissue injuries. There
was lack of research to compare the effect of these three different treatments of therapy on selected soft tissue injuries, such as rotator cuff tear, ankle sprain and ACL injuries. Hence, in this research an attempt was made to find out the effect of short wave diathermy, ultrasound therapy and wax bath and massage on soft tissue injuries of shoulder, knee and ankle joints on basketball and volleyball players.