CHAPTER II

REVIEW OF RELATED LITERATURE
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The review of literature is very important in the process of the research because it forms the basic foundation upon which the future research is built. It gives a wide knowledge about the research problem and its background concepts and ideas which were the contribution from experts in our field. Previously proved theories and literature reveals the problem and also understanding of various approaches available for such a study. It also provided ideas about the techniques of data analysis and interpretation for such a study. Also from previous studies, the investigator came to know that similar study has not been conducted before. The past literatures also give idea about reliable and valid tools for the assessment of selected variables. All the above things may be accomplished only by doing a systematic review of literature. The reviews of literature have been classified under the following headings:

1. Reviews on Prevalence of Pain in Sportsmen
2. Reviews on Multidisciplinary Approach on Pain
3. Reviews on Interferential Therapy
4. Reviews on TENS
5. Reviews on PEMF
6. Reviews on Reliability of Pain Assessment tools
REVIEWS ON PREVALENCE OF PAIN IN SPORTSMEN

Saraux A et al, (1999) Objective: Tennis practiced intensively is generally held to be a risk factor for low back pain. The objective of our study was to evaluate the prevalence of low back pain with or without sciatica during the last week in tennis players versus controls. Patients and Methods: During an international tennis competition held in Brest, France, ten physicians or medical students interviewed 633 spectators older than 18 years and divided them into tennis players and controls. The sample size was selected to allow detection of a twofold increase in the risk of low back pain in tennis players (with alpha = 5% and 1-beta = 80%). Results: Of the 633 subjects, 388 were and 245 were not tennis players. There were 421 men with a mean age of 37 +/- 13.7 years and 212 women with a mean age of 34.3 +/- 12.7. Among the men, 49 of the 281 tennis players (17.4%) reported low back pain during the last week versus 26 of the 140 controls (18.6%). Corresponding figures in women were 20 of 107 tennis players (18.7%) and 29 of 105 controls (27.6%). Sciatica was not more common in tennis players (men, 20 of 281 tennis players [7.1%] versus 6 of 140 controls [4.3%]; women, 8 of 107 tennis players [7.5%] versus 10 of 105 controls [9.5%]). None of the differences between tennis players and controls were significant. The number of hours spent playing tennis per week was similar in tennis players with and without low back pain. Conclusion: Our interview-based cross-sectional study found no evidence that playing tennis involves a higher risk of low back pain with or without sciatica.

Alfred son et al, (2001) studied on Painful conditions in the Achilles tendon region, a common problem in middle-aged competitive badminton players. Overuse injuries are the most frequent type in badminton, generally localized in the legs. An earlier study found 32% of young Swedish elite badminton players to
have experienced disabling pain in the Achilles tendon region during the previous 5 years. The present investigation examined the prevalence and characteristics of painful conditions in the Achilles tendon region in 32 middle-aged competitive badminton players by means of questionnaire and physiotherapist’s examination. Pain in the Achilles tendon region was reported by 44%, either presently or during the past 5 years, generally localized in the middle portion of the tendon. Symptoms had lasted 2 weeks-1 year (96 days). Age was found to be correlated to Achilles tendon pain, but there was no relationship between symptoms of pain and body mass index, gender, training quantity, or years of playing badminton. In conclusion, Achilles tendon pain seems to be relatively common among Swedish middle-aged competitive badminton players, particularly in the older ones.

**Fossan B et al, (2004)** Objective: To compare the prevalence of symptoms of low back pain between endurance sports with different loading characteristics on the lumbar region: cross-country skiing, rowing, and orienteering, as well as a nonathletic control group. Methods: Self-reported questionnaire on low back pain adapted for sports based on standardized Nordic questionnaires for musculoskeletal symptoms. Responders were 257 cross-country skiers (response rate: 100%), 199 rowers (99.5%), and 278 orienteerers (99.3%), and 197 control subjects (66%). Results: Low back pain was reported to be somewhat more common among cross-country skiers and rowers than orienteerers and nonathletic controls. The prevalence among cross-country skiers of reported low back pain ever (65.4%) and low back pain during the previous 12 months (63.0%) was higher than nonathletic controls (OR [95% CI]: 1.94 [1.29-2.92]). Rowers (25.6%) reported missing training because of low back pain more frequently than orienteerers did (13.7%, OR: 2.16 [1.25-3.74]). The athletes reported more low back pain during periods when training and competition load was higher, and cross-country skiers more frequently reported
having low back problems using classic than freestyle skiing techniques. Conclusions: Low back pain appears to be somewhat more common in endurance sports that specifically load the low back during training and competition. The relationship between seasonal training patterns and specific skiing techniques indicate that there is a relationship between low back pain and the specific loading patterns of skiing and rowing.

**Martin Fahlström et al, (2005)** conducted a study, Shoulder pain which is a common problem in world-class badminton players, to find out the prevalence of shoulder pain in players. Badminton is a sport that requires a lot of over-shoulder motion, with the shoulder in abduction/external rotation. This questionnaire study on 188 international top-level badminton players during the World Mixed Team Championships showed that previous or present shoulder pain on the dominant side was reported by 52% of the players. Previous shoulder pain was reported by 37% of the players and on-going shoulder pain by 20% of the players. There were no significant differences in the prevalence of shoulder pain between men and women. The majority of the shoulder pain had started gradually. The pain was usually associated with shoulder activity, and stiffness was a common, associated symptom. Furthermore, the shoulder pain was associated with consequences such as sleeping disturbances, changes in training and competition habits, and it also affected activities of daily living. The majority of the players had sought medical advice and had been given different kinds of treatment. The study showed that shoulder pain is a common and significant problem in world-class badminton players, and the consequences are most likely of importance for their training and playing capacity.

**Reinking MF et al, (2006)** Purpose: To examine prospectively the effect of selected extrinsic and intrinsic factors on the development of exercise-related leg pain in female collegiate athletes. Study Design: Cohort study; Level of evidence, 2. Methods: Subjects were 76 female collegiate athletes participating in fall season sports, including cross-country running, field hockey, soccer, and volleyball. Athletes were seen for a pre-season examination that included
measures of height, weight, foot pronation, and calf muscle length as well as a questionnaire for disordered eating behaviors. Body mass index was calculated from height and weight (kg/m^2). Those athletes who developed exercise-related leg pain during the season were seen for follow-up. All athletes who developed the condition and a matched group without such leg pain underwent bone mineral density and body composition testing. Statistical analyses of differences and relationships were conducted. Results: Of the 76 athletes, 58 (76%) reported a history of exercise-related leg pain, and 20 (26%) reported occurrence of exercise-related leg pain during the season. A history of this condition was strongly associated with its occurrence during the season (odds ratio, 13.2). Exercise-related leg pain was most common among field hockey and cross-country athletes and least common among soccer players. There were no differences between athletes with and without such leg pain regarding age, muscle length, self-reported eating behaviors, body mass index, menstrual function, or bone mineral density. Athletes with exercise-related leg pain had significantly (P < .05) greater navicular drop compared with those without.

Conclusion: Exercise-related leg pain was common among this group of female athletes. The results suggest that there are certain factors, including foot pronation, sport, and a history of this condition, that are associated with an increased risk of exercise-related leg pain.

Söderman K et al, (2006) The aim of this study was to describe the prevalence and consequences of painful conditions in the shoulder region in recreational badminton players. A questionnaire study was performed on 99 players, of whom 57 were also assessed with Constant score. Previous or present pain in the dominant shoulder was reported by 52% of the players. Sixteen percent of the players had on-going shoulder pain associated with badminton play. A majority of these players reported that their training habits were affected by the pain. Total Constant score was lower in the painful shoulders. Furthermore, range of active pain-free shoulder abduction was decreased. However, isometric shoulder strength test showed no differences
when compared with pain-free shoulders. Even though the pain caused functional problems, the players were still playing with on-going symptoms. The diagnoses were mostly unknown, although history and clinical tests indicate problems resembling subacromial impingement.

**Gregory PL et al, (2007)** Objective: To describe the impact of shoulder injuries on professional cricketers during the 2005 England and Wales first class cricket season. Design: Professional cricketers in England were asked to complete two questionnaires relating to shoulder injuries. Players who returned both questionnaires were included in this study. Main outcome measurements: The impact of any shoulder pain whilst playing cricket, impaired cricketing performance and shoulder injury related problems during training and activities of daily living. Results: One hundred and fifty eight of a total of 378 players (42%) returned both questionnaires. Twenty-three per cent of the participants described shoulder injury during the 2005 season. Injury prevalence (the percentage of players not available for selection in a match due to shoulder injury) was 1.7%. Sixty-four per cent of shoulder injured players often or always had associated problems when fielding, and 58% of shoulder injured players fielded in a specific position to avoid shoulder injury related problems. Eighteen per cent of all study participants felt pain on throwing at some stage during the survey period. Conclusions: Professional cricketers generally play on with shoulder injuries without missing matches, though their performance, especially during fielding, is often compromised. Research into the diagnoses, aetiology, appropriate treatment and prevention of shoulder injuries in cricket is required.

**Feddermann N et al, (2008)** Purpose: The intake of medication in female and adolescent male soccer players has not yet been investigated. Study Design: Descriptive epidemiology study. Material: Team physicians reported 10,456 uses of medication 72 hours before each match in 2488 soccer players participating in 6 international soccer tournaments. Results: The use of a total of 6577 medical substances was reported, leading to an average intake of 0.63 substances per player per match (under-17s, 0.51; under-20s, 0.51; women, 1.0;
Nonsteroidal anti-inflammatory drugs were the most commonly prescribed type of medication in all tournaments. Women’s soccer had the highest percentage of players using nonsteroidal anti-inflammatory drugs per match (under-17s, 17.3%; under-20s, 21.4%; women, 30.7%; \( P < \text{or} = .001 \)). Relatively few players were taking beta(2)-agonists for the treatment of asthma (under-17s, 1.3%; under-20s, 1.3%; women, 4.3%; \( P < \text{or} = .001 \)). Conclusion: These findings highlight the existing problem of excessive medication use in international top-level women’s and male youth soccer nearly to the same extent as in men’s soccer. Further steps need to be taken to understand the rationale underlying the sports physicians’ practice and to plan educational programs to avoid the abuse of prescription medication. Clinical Relevance: Continued abuse of medication may otherwise not only negatively influence the quality of the game but also the health status of the players.
REVIEWS ON MULTIDISCIPLINARY APPROACH ON PAIN

Sarna Set al, (1997) studied the lifetime occurrence of musculoskeletal symptoms in former elite male athletes: 29 weight-lifters, 31 soccer players, 28 long-distance runners, and 29 shooters, 45-68 years of age. The proportion of subjects with monthly back pain during the past year was smaller among runners than among the other athletes, although not statistically significant. Monthly back pain was more common in weight-lifters with lifetime training hours above the median as compared with those below the median. The average intensity of the worst back pain during the past year was clearly higher in weight-lifters and soccer players, than in runners and shooters. Knee pain at least once a month during the past year was reported by 52% (CI 33-70%) of the soccer players, 31% (CI 15-51%) of the weight lifters, 21% (CI 8-41 %) of the runners, and 17% (CI 6-36%) of the shooters (p = 0.019). Soccer players had the highest number of sports-related knee injuries (p < 0.0001). Past knee injuries were associated with knee pain in later adulthood (p = 0.048). In conclusion, compared with shooters, athletes formerly exposed to heavy exercise did not report more frequent back pain during the past year, whereas a high intensity of back pain was typical of soccer players and weight-lifters. A predisposition to knee injuries in soccer players appears to increase the risk of future knee pain. Similarly, knee pain later in life seems to be more common in weight-lifters than in runners and shooters. Long-distance runners, on the other hand, are prone to an increased lifetime risk of hip pain.

Black K et al, (1999) - Study Design: Descriptive self-report survey. Objectives: To assess activity level, medical history, and the prevalence and intensity of shoulder and upper extremity pain experienced during functional activities in female athletes who compete in wheelchairs. Methods and Measures: Forty-six female wheelchair basketball players completed an anonymous survey that included demographic data, medical history data, and the Wheelchair User’s Shoulder Pain Index (WUSPI). The WUSPI is a valid and
reliable self-report measure scored from 0 to 150, with higher scores indicating a greater intensity of shoulder pain during functional activities. Results: The average age of the respondents was 33.2 (+/- 9.1) years, with an average of 12.5 (+/- 10.2) years of wheelchair use. Their disabilities included 39% spinal cord injury, 28% various lower extremity musculoskeletal and neuromuscular disabilities, 13% postpolio paralysis, 11% spina bifida, and 9% amputations. Only 14% of the subjects reported shoulder pain prior to wheelchair use. In contrast, 72% of the subjects reported shoulder pain since wheelchair use, with 52% reporting current shoulder pain. Overall, the subjects scored an average +/- SD performance-corrected total WUSPI score of 15.6 +/- 20.5 on a scale of 0 to 150 points, with 0 representing no pain. The highest intensity of shoulder pain was reported during household chores, propulsion on ramps or inclines, lifting overhead, and while sleeping. Conclusions: Shoulder and upper extremity pain was a very common problem reported by over 90% of the subjects in this study. Prevention of pain and chronic disability in athletes who use wheelchairs should be addressed by coaches, players, and health care professionals.

Irvin E et al, (2002) Objectives: To assess the effect of multidisciplinary bio-psycho-social rehabilitation on pain, function, employment, quality of life and global assessment outcomes in subjects with chronic disabling low back pain. Selection Criteria: Design: randomized controlled trials comparing multidisciplinary bio-psycho-social rehabilitation with a non-multidisciplinary control intervention. Population: Adults with disabling low back pain of more than three months in duration. Intervention: Patients had to be assessed and treated by qualified professionals according to a plan that addresses physical and at least one of psychological or social/occupational dimensions. Outcomes: Only trials which reported treatment effect in at least one of pain, function, employment status, quality of life or global improvement. Exclusion: Pure educational interventions (back schools) and pure physical interventions were excluded. Main Results: Ten trials (12 randomised comparisons) were included.
They randomised a total of 1964 patients with chronic low back pain. There was strong evidence that intensive multidisciplinary bio-psycho-social rehabilitation with a functional restoration approach improved function when compared with inpatient or outpatient non-multidisciplinary treatments. There was moderate evidence that intensive multidisciplinary bio-psycho-social rehabilitation with a functional restoration approach improved pain when compared with outpatient non-multidisciplinary rehabilitation or usual care. There was contradictory evidence regarding vocational outcomes of intensive multidisciplinary bio-psycho-social intervention. Some trials reported improvements in work readiness, but others showed no significant reduction in sickness leaves. Less intensive outpatient psycho-physical treatments did not improve pain, function or vocational outcomes when compared with non-multidisciplinary outpatient therapy or usual care. Few trials reported effects on quality of life or global assessments. Conclusions: The reviewed trials provide evidence that intensive multidisciplinary bio-psycho-social rehabilitation with a functional restoration approach improves pain and function. Less intensive interventions did not show improvements in clinically relevant outcomes.

Chung OY et al, (2006) Aim of the study: To identify the Psychological and Behavioural aspects of Complex Regional Pain Syndrome management. Psychological and behavioral factors can exacerbate the pain and dysfunction associated with complex regional pain syndrome (CRPS) and could help maintain the condition in some patients. Effective management of CRPS requires that these psychosocial and behavioral aspects be addressed as part of an integrated multidisciplinary treatment approach. Patients with acute CRPS (<6-8 weeks) may not need additional psychological care. All patients with chronic CRPS should receive a thorough psychological evaluation, followed by cognitive-behavioral pain management treatment, including relaxation training with biofeedback. The psychological component of treatment can work synergistically
with medical and physical/occupational therapies to improve function and increase patients' ability to manage the condition successfully.

**Bunney WE et al, (2006)** - This paper defines a symptom construct termed psychological pain and reviews clinical and neuroimaging evidence relevant to it. The psychological pain associated with severe depression is often perceived as worse than any physical pain that the individual has experienced and could be a critical component of suicidality that could be systematically assessed in potentially suicidal patients. Converging evidence from brain imaging studies suggests overlapping patterns of brain activation induced by both psychological pain and by physical pain. Future research on the role of psychological pain and its interaction with nociceptive pathways may provide novel clues to the understanding and treatment of depression and other psychiatric illnesses.

**Tiktinsky R et al, (2007)** studied about use of electrotherapy which has been part of physical therapy treatment for the past few decades. There have been numerous modalities used such as TENS, interferential, diathermy, magnetic therapy, ultrasound, laser and surface electromyography to name a few. There has been an upsurge in the past decade of new and innovative modalities. There needs to be extensive research on each of these electrotherapy devices to determine the proper use of each device.

**Ruzicka S et al, (2007)** researched about the Holistic Assessment of chronic pain among elders. This pilot study assessed pain using 7 dimensions of pain (physiologic, behavioral, sensory, affective, cognitive, sociocultural, and spiritual) to better understand and identify patterns of elder response to chronic pain within a holistic framework. Previously validated instruments were used to assess 150 cognitively intact subjects, aged 65 years and older, with chronic
pain. Thirteen patterns were identified reflecting distinct patterns of pain response. Two patterns comprised 85% of the responses: (1) high spiritual well-being, low physiologic pain, and high perceived independent functioning; and (2) high spiritual well-being, low physiologic pain, and lower perceived independent functioning. The 11 other patterns of pain response also varied in their responses to the pain experience. These responses reflect the unique and holistic experience of chronic pain among older adults. Holistic assessment enhances the understanding of the pain specific to the individual. Self-perceived functional dependence and the spiritual component significantly influence chronic pain experiences.

Hippie E et al, (2007) Purpose: To assess the prevalence of depressive symptoms and difficulty with pain in retired professional football players, difficulties with the transition from active athletic competition to retirement. Methods: Survey sent to 3377 retired members of the National Football League Players Association (NFLPA), with usable responses received from 1617 members (functional response rate, 48.6%). Results: Respondents were categorized as experiencing no to mild depression (N=1366; 84.5%) or moderate to severe depression (N=237; 14.7%). Respondents were also categorized according to whether they reported difficulty with pain as not or somewhat common (N=837; 51.8%) versus quite or very common (N=769; 47.6%). Conclusion: Retired professional football players experience levels of depressive symptoms similar to those of the general population, but the impact of these symptoms is compounded by high levels of difficulty with pain. The combination of depression and pain is strongly predictive of significant difficulties with sleep, social relationships, financial difficulties, and problems with exercise and fitness. A hypothesis explaining this association is that significant musculoskeletal disability and chronic pain interferes with physical activity and fitness during retirement and increases the risk of depression.
REVIEWS ON IFT

In 1999, Werners et al, conducted a randomised trial comparing IFT against motorised lumbar traction with massage in the management of low back pain, using 152 participants. The authors concluded that despite the progressive reduction in disability score, there was no significant difference between the two treatments.

Brian Awbrey et al, (2001) evaluated patients after soft tissue arthroscopy of the knee using both energized and non-energized (placebo) Interferential Therapy units. Compared to the placebo users, users of the energized interferential stimulation units experienced: a 45% decrease in post operative tenderness after 10 days , a 23% decrease in knee swelling, a 35% decrease in the need for pain control medication. These and other studies have convinced most insurance carriers to recognize, approve and reimburse for interferential stimulation therapy

Walsh DM et al, (2001) - The current study was designed to examine the neurophysiological and hypoalgesic effects of three types of electrical stimulation. Following approval by the University's Research Ethical Committee, healthy volunteers (n=40; 20 males and 20 females; age 20-40 years; mean age 26.18 years) were recruited and screened for contraindications. Subjects were randomly allocated in equal numbers to the following groups: control, transcutaneous electrical nerve stimulation (TENS; 150 Hz, 125 micros), interferential therapy (IFT; 150 Hz, 125 micros) or action potential stimulation therapy (APS; 153 Hz, 6.4 ms). All treatments were applied under double-blind conditions for 15 min over the course of the median nerve in the subject's right forearm. Antidromic median nerve compound action potentials were recorded pretreatment, immediately post-treatment (i.e. at 15 min) and then at 25, 35 and 45 min. Immediately following CAP recording, mechanical pain threshold was recorded from two sites on the palmar surface of the right hand. Statistical analysis showed significant differences between groups for peak to peak
amplitude at 25, 35 and 45 min (Kruskal-Wallis: P=0.01, 0.01 and 0.02). Mann-Whitney U-tests indicated a significant increase in PPA in the IFT group compared with all other groups at 25 and 35 min and compared with the TENS and APS groups at 45 min. No significant differences were found for the MPT data. This study has therefore demonstrated that none of the aforementioned modalities produced a significant hypoalgesic effect; however, IFT produced a significant change in PPA compared with TENS and APS.

**Johnson Ml et al, (2002)** - The aim of this single-blind placebo-controlled study was to examine the analgesic effects of interferential currents on experimentally induced ischaemic pain. Ischaemic pain was induced using the submaximal effort tourniquet technique and pain intensity was recorded using a visual analogue scale at 1-min an interval was used as the primary outcome measure. Following baseline recordings 30 healthy volunteers received active IFC, sham IFC, or no treatment (10 subjects per group). Data were analysed by calculating the mean change in pain intensity at each 1-min interval by subtracting data during treatment from the baseline data. IFC was administered throughout the duration of the ischaemic pain test via four electrodes on the forearm. Active IFC delivered electrical currents at a 'strong but comfortable' intensity. A 'dummy' stimulator that delivered no current was used as sham IFC. Subjects in the no treatment control group were informed that the IFC device was not switched on. There were significant effects for Groups (P=0.04) which were attributed to a significant reduction in pain intensity for the IFC group when compared with sham and no-treatment control (P< or =0.05). There were no significant effects for Time (P=0.69) or Group-Time interaction (P=0.45). In conclusion, IFC produced significantly greater analgesia than sham and no-treatment control groups under the present experimental conditions.

**Glousman RE et al, (2002)** - Objective: We studied the effects of home interferential current therapy on postoperative pain, range of motion, and edema in subjects undergoing anterior cruciate ligament reconstruction, menisectomy, or
knee chondroplasty. Design: Randomized, double-blind, placebo-controlled prospective study. Setting: A tertiary care outpatient orthopaedic clinic/ambulatory surgery center. Subjects: Eighty-seven subjects were separated into three groups based on their type of knee surgery and within each group randomized into a treatment or placebo group. Interventions: All subjects received home IFC units. Subjects randomized to treatment group received a working IFC unit. Placebo subjects received units that were previously set to deliver no current. Main Outcome Measurements: Post-operative edema at 24, 48, and 72 hours, and weeks 1-8; range of motion at 1, 3, 6, and 9 weeks; pain immediately after surgery, at 24, 48, and 72 hours, and weeks 1-7; and amount of pain medication taken at days 1-10 were compared between treatment and placebo groups. Results: All IFC subjects reported significantly less pain and had significantly greater range of motion at all post-operative time points. ACL and menisectomy IFC subjects experienced significantly less edema at all time points, while chondroplasty subjects experienced significantly less edema until 4 weeks postoperatively. Conclusions: These findings indicate that home IFC may help reduce pain, pain medication taken, and swelling while increasing range of motion in patients undergoing knee surgery. This could result in quicker return to activities of daily living and athletic activities.

In 2003, a study performed by Kerlan-Jobe et al, with the purpose to find out the effectiveness of IFC on athletes. This randomized, double-blind, placebo-controlled study on sports players undergoing ACL reconstruction, menisectomy, or knee chondroplasty concluded that “home IFC may help reduce pain, pain medication taken, and swelling while increasing range of motion in patients undergoing knee surgery. This could result in quicker return to activities of daily living and athletic activities.”

Hui-Chan CW et al, (2003) - This study examined whether transcutaneous electrical nerve stimulation or interferential current was more effective in reducing experimentally induced heat pain. Forty-eight young healthy subjects were randomly divided into the following groups: (i) transcutaneous
electrical nerve stimulation; (ii) interferential current; and (iii) no stimulation. A multi-function electrical stimulator was used to generate the transcutaneous electrical nerve stimulation or interferential current. A thermal sensory analyser was used to record the heat pain threshold. The stimulation lasted for 30 minutes and the heat pain thresholds were measured before, during and after the stimulation. Transcutaneous electrical nerve stimulation ($p = 0.003$) and interferential current ($p = 0.004$) significantly elevated the heat pain threshold, but "no stimulation" did not. The thresholds of the transcutaneous electrical nerve stimulation and interferential current groups were significantly higher than that of the control group 30 minutes into the stimulation ($p = 0.017$). Both transcutaneous electrical nerve stimulation and interferential current increased the heat pain threshold to a similar extent during stimulation. However, the post-stimulation effect of interferential current lasted longer than that of transcutaneous electrical nerve stimulation.

**Kwon BS et al, (2003)** Objective: The purpose of this study was to evaluate the effect of interferential current therapy (IFT) of swing pattern frequency alteration on the RIII nociceptive reflex. METHOD: Ten healthy volunteers received IFT of both constant (100 Hz) and swing (20~100 Hz) pattern frequency. Before and after the IFT application RIII nociceptive reflex was evoked by stimulation of sural nerve and recording at biceps femoris muscle. Twenty nine patients with low back pain were treated with IFT of constant or swing pattern frequency and degrees of pain relief were evaluated by Visual Analogue Scale (VAS) and Present Pain Intensity (PPI). Results: The threshold of RIII reflex was increased immediately after both constant and swing frequency, but the increased threshold was lasted for 15 minutes only after swing pattern frequency alteration. Pain relieving effect of IFT evaluated by PPI was also lasted for 15 minutes only after swing frequency alteration. Conclusion: These results suggest that IFT of swing pattern frequency alteration had longer lasting effect on the inhibition of RIII nociceptive reflex and the relief of pain than that of constant frequency.
Walker et al (2006), proved by their evidence based research that, logically one could use the higher frequencies (90-130Hz) of IFT to stimulate the pain gate mechanisms & thereby mask the pain symptoms. Alternatively, stimulation with lower frequencies (2-5Hz) can be used to activate the opioid mechanisms, again providing a degree of relief.

Tugay N et al, (2007) - Objective: To compare the effectiveness of *transcutaneous electrical nerve stimulation and interferential current in primary dysmenorrhea*. Design: A prospective, randomized, and controlled study. Setting: Hacettepe University School of Physical Therapy and Rehabilitation. Patients: Thirty-four volunteer subjects with primary dysmenorrhea (mean age: 21.35 +/- 1.70 years) were included. Statistical analyses were performed in 32 subjects who completed all measures. Interventions: Fifteen subjects received interferential current application for 20 minutes and 17 subjects received transcutaneous electrical nerve stimulation for 20 minutes when they were experiencing dysmenorrhea. Outcome Measures: Physical characteristics, years since menarche, length of menstrual cycle, and duration of menstruation were recorded. Visual analog scale intensities of menstrual pain, referred lower limb pain, and low back pain were recorded before treatment, and immediately, 8 hours, and 24 hours after treatment. Results: Intensities of the evaluated parameters decreased beginning from just after the applications in both groups (P<0.05). Intensity of referring low back pain in first three measurement times was different between the groups (P<0.05), but this difference is thought to be due to the baseline values of the groups. So, it can be said that no superiority existed between the methods (P>0.05). Conclusion: Both transcutaneous electrical nerve stimulation and interferential current appear to be effective in primary dysmenorrhea. As they are free from the potentially adverse effects of analgesics, and no adverse effects are reported in the literature nor observed in this study, a clinical trial of their effectiveness in comparison with untreated and placebo-treated control groups is warranted.
REVIEWS ON TENS

Hillman SK et al, (1985) researched about the use of Physical agents in Rehabilitation of Athletic injuries. The competitive athlete’s motivation to return to activity following injury presents a challenge to the sports medicine specialist to utilize the most effective rehabilitation procedures available. Safe return to competition necessitates maximal restoration of those components of physical fitness affected by injury (such as muscular strength, power, and endurance). Various forms of superficial heat and cold application, deep heat modalities, and electrical currents have been used to supplement therapeutic exercise in this process. In recent years, the therapeutic benefits of cold for the control of exercise-induced edema and as a prelude to performance of prescribed exercise have been widely recognized. Although short wave and microwave diathermy appear to have lost much of their appeal as deep tissue heating modalities, the thermal and mechanical effects of ultrasound continue to make it a widely used modality in sports medicine. Adaptation of alternating electrical currents for use of transcutaneous nerve stimulation has given the sports medicine clinician a useful modality for pain management. The more recently developed “Russian” electrical stimulator provides a promising modality for muscle re-education and restoration of muscular strength.

Graff-Radford SB et al, (1989) The effects of transcutaneous electrical nerve stimulation on myofascial pain and trigger point sensitivity were assessed. Four modes of TENS and a no-stimulation control were compared in a double-blind design. Stimulation, carried out for 10 min on 60 subjects (12/group), showed significant pain reductions with 100 Hz, 250 msec stimulation followed by 100 Hz, 50 msec and then pain suppressor TENS. No pain reductions were found in the 2 Hz, 250 msec TENS or the control. No significant alteration in myofascial trigger point sensitivity, assessed with the pressure algometer, was found between the groups. The results suggest that high frequency, high
intensity TENS is effective in reducing myofascial pain, and that these pain reductions do not reflect changes in local trigger point sensitivity.

Rigardo S et al, (1990) The aim of this paper is to evaluate the effectiveness of high-intensity versus low-intensity transcutaneous electrical nerve stimulation and versus placebo for treatment of hemiplegic shoulder pain. Three groups of 20 patients each (A, B, C) were studied. In group A high-intensity TENS was delivered at 3 times the sensory threshold with frequency of 100 Hz; in group B low-intensity TENS was delivered at the sensory threshold with frequency of 100 Hz. Group C received placebo stimulation. The treatment protocol consisted of 12 sessions (4 weeks). Before treatment, at the end of it and one month after, passive range of motion (PROM) for flexion, extension, abduction and external rotation were evaluated. Statistically significant improvements of PROMs were recorded for group A, but not for groups B or C.

In a study done by Thomas Lundeberg (2001), from the Dept. of Physiology and Pharmacology at the Karolinska Institute in Sweden, on the effect of TENS vs. naproxen - an orally administered pain medication on ankle pain, it was found that high-intensity TENS is an effective and safe form of therapy for pain. Especially when the pain is believed to be secondary to local ischemia as opposed to neurogenic or musculoskeletal origin, success rate was considered to be around 90 percent, with onset of pain relief around 60 seconds. This fact shows us that there may be other mechanisms involved other than direct suppression of nociceptive activity in spinal nerve fibers, as in the Gate Control theory. These results involving pain and ischemia also are positive when considering headache relief. As a final possible explanation for the efficacy of TENS, found that "electrical stimulation is followed by a decrease in the excitatory amino acids glutamate and aspartate in the dorsal horn, which is mediated by a GABAergic mechanism”. In other words, inhibition of nociceptive neurons at the spinal cord level may involve GABA, as evidenced by
counteraction of inhibition by GABA antagonists. He notes, however, that knowledge about the mechanisms underlying the effects of TENS is limited and further research is necessary to discover full potential of such treatment.

Stones RW et al, (2003) Objectives: To determine the effectiveness of high and low frequency transcutaneous electrical nerve stimulation and acupuncture when compared to each other, placebo, no treatment, or medical treatment for primary dysmenorrhoea. Selection Criteria: The inclusion criteria were randomised controlled trials of transcutaneous electrical nerve stimulation and acupuncture that compared these treatments to each other, placebo, no treatment, or medical treatment for primary dysmenorrhoea. Exclusion criteria were: mild, infrequent or secondary dysmenorrhoea and dysmenorrhoea associated with an IUD. Data Analysis: Nine RCTs were identified that fulfilled the inclusion criteria for this review, seven involving TENS, one acupuncture, and one both treatments. Quality assessment and data extraction were performed independently by two reviewers. Meta analysis was performed using odds ratios for dichotomous outcomes and weighted mean differences for continuous outcomes. The outcome measures were pain relief (dichotomous, visual analogue scales, descriptive), adverse effects, use of analgesics additional to treatment and absence from work or school. Main Results: Overall high frequency TENS was shown to be more effective for pain relief than placebo TENS. Low frequency TENS was found to be no more effective in reducing pain than placebo TENS. There were conflicting results regarding whether high frequency TENS is more effective than low frequency TENS. One small trial showed acupuncture to be significantly more effective for pain relief than both placebo acupuncture and two no treatment control groups. Conclusions: High frequency TENS was found to be effective for the treatment of dysmenorrhoea by a number of small trials. There is insufficient evidence to determine the effectiveness of low frequency TENS in reducing dysmenorrhoea. There is also insufficient evidence to determine the effectiveness of acupuncture in reducing dysmenorrhoea.
Demircan et al, (2005) investigated the efficacy of transcutaneous electrical nerve stimulation for postthoracotomy pain control in a prospective, randomized, double-blind, placebo-controlled study. We studied two groups of patients undergoing posterolateral thoracotomy. In group 1, TENS was used postoperatively on 60 patients for 5 days. Group 2 contained 56 patients without TENS. In both groups a visual analog scale was used to indicate if analgesia was needed. When the VAS was higher than 4, an analgesic was administered. We observed the forced expiratory volume in 1 second (FEV₁), the forced vital capacity (FVC), partial arterial oxygen pressure (PaO₂), partial arterial carbon dioxide pressure (PaCO₂), and how many doses of analgesia were given at postoperative 0 (extubation time), 2, 6, 12, 24, 48, 72, and 120 hours. TENS was not employed in patients with cardiac or neurologic disease. In group 1, TENS reduced the need to administer opioids during the 5-day postoperative period. This result is statistically significant ($P = 0.013$). Additionally, following the sixth postoperative hour, TENS increased the spirometric breath function. The FEV₁, FVC, and PaO₂ were high and PaCO₂ was low when the first group is compared to the second. All these results are statistically significant ($P = 0.012$, $P = 0.01$, $P = 0.024$, and $P = 0.02$ respectively). We observed that TENS produced no evidence of side effects or intolerance in the patients of group 1. TENS is thus beneficial for pain relief following thoracotomy and has no side effects. Consequently, the routine use of TENS following thoracic surgery is recommended.

DeSantana JM et al, (2008) studied the Effectiveness of TENS for Treatment of Hyperalgesia and Pain. Transcutaneous electrical nerve stimulation is a nonpharmacologic treatment for pain relief. TENS has been used to treat a variety of painful conditions. This review updates the basic and clinical science regarding the use of TENS that has been published in the past 3 years (ie, 2005-2008). Basic science studies using animal models of inflammation show changes
in the peripheral nervous system, as well as in the spinal cord and descending inhibitory pathways, in response to TENS. Translational studies show mechanisms to prevent analgesic tolerance to repeated application of TENS. This review also highlights data from recent randomized, placebo-controlled trials and current systematic reviews. Clinical trials suggest that adequate dosing, particularly intensity, is critical to obtaining pain relief with TENS. Thus, evidence continues to emerge from both basic science and clinical trials supporting the use of TENS for the treatment of a variety of painful conditions while identifying strategies to increase TENS effectiveness.

Emmiler M et al, (2008) Objective: We investigated the effectiveness of transcutaneous electrical nerve stimulation therapy on pain during the first 24 hours after a cardiac surgical procedure. Methods: A total of 60 patients who had undergone median sternotomy for coronary artery bypass graft (n = 55) or valve repair surgery (n = 5) were randomized to receive TENS and pharmacologic analgesia, placebo TENS and pharmacologic analgesia, or pharmacologic analgesia alone (control group). For each group we recorded severity of pain, analgesic intake, and pulmonary complications. Pethidine HCL and metamizol sodium were administered for post surgical analgesia. Results: Pain after MS was measured on a 10-point visual analogue scale (VAS). Mean scores in the TENS, placebo TENS, and control groups, respectively, were 5.70 +/- 1.78, 5.75 +/- 1.83, and 5.95 +/- 1.63 before treatment (P > .05); 2.40 +/- 1.18, 3.90 +/- 1.48, and 3.55 +/- 1.60 on the 12th hour of the intervention (P < .05); and 1.25 +/- 0.91, 2.30 +/- 1.34, and 2.15 +/- 1.13 on the 24th hour of the intervention (P < .05). The mean VAS scores decreased within each group (P < .05). However, the mean VAS scores decreased much more significantly in the TENS group (P < .05). Metamizol sodium intake was 1.05 +/- 0.39 g, 2.30 +/- 1.08 g, and 2.90 +/- 1.20 g and pethidine HCL intake was 17 +/- 16.25 mg, 57 +/- 21.54 mg, and 51.50 +/- 18.99 mg, respectively, in the TENS, placebo TENS, and control groups. Metamizol sodium and pethidine HCL intake was least in the TENS group (P < .05). Postoperative complications were observed in 6 (10%) of patients. The
most frequent complication was atelectasia. Conclusions: TENS was more effective than placebo TENS or control treatments in decreasing pain and limiting opioid and nonopioid medication intake during the first 24-hour period following MS.

**Ekim A et al, (2008)** Objective: To evaluate the efficacy of transcutaneous electrical nerve stimulation therapy on shoulder pain and upper extremity functions in hemiplegic patients. Material-Methods: Total of 19 hemiplegic patients with shoulder pain were as consecutive randomly assigned into two groups. TENS was applied in group 1 (n = 10) for 20 minutes and group 2 (n = 9) received placebo stimulation. Conventional rehabilitation program were applied total 15 sessions during a period of 3 week in both groups. The visual analog scale to evaluate shoulder pain, Barthel Index for daily-life activities were used. The shoulder passive range of motions and Brunnstrom stage of motor recovery were measured. Results: Clinical parameters were similar at baseline. In both groups, significant improvements were observed in VAS and BI (group 1: p<0.001; group 2: p<0.05). In VAS (p<0.001), and BI (p<0.05) were showed significant improvements in favor of group 1, when compared with the groups. In PROMs of abduction and external rotation of shoulder significant improvements were observed in only group 1 (p<0.001, p<0.001 respectively). There was not any significant improvement on Brunnstrom stage of motor recovery in both groups (p>0.05). Conclusion: In conclusion that TENS therapy together with conventional rehabilitation could be used as a good alternative therapy in patients with hemiplegic shoulder pain.
REVIEWS ON PEMF

 Kellogg R et al, (1993) - A need exists to develop new methods of neuromuscular electrical stimulation that are both effective and relatively pain-free. The purpose of this pilot study was to determine the effects of both NMES and a new method of electromagnetic stimulation for reducing girth loss and for reducing pain and muscle weakness of the knee extensor muscles in patients during the first 6 weeks after reconstructive surgery of the anterior cruciate ligament (ACL). Seventeen patients receiving ACL reconstructive surgery participated as a control group (N = 3), as an NMES group (N = 7), and with combined NMES and magnetic field stimulation (NMES/PEMF) (N = 7). Patients receiving NMES/PEMF rated each type of stimulation for perceived pain and were measured for their torque. Torque results revealed a mean decrease of 13.1% for NMES/PEMF patients. The mean percent of thigh girth decreased 8.3% for controls, 0.5% for NMES, and 2.3% for NMES/PEMF patients. The NMES/PEMF patients rated NMES as causing about twice the pain intensity as NMES/PEMF during treatments. As a result of this data, the authors conclude that both NMES and NMES/PEMF are effective in reducing girth loss and that NMES/PEMF is less painful than NMES alone in treating patients after ACL reconstruction.

 Jorgensen WA et al, (1998) aimed at demonstrating the Effects of PEMF on Tissue trauma and Pain. Unusually effective and long-lasting relief of pelvic pain of gynecological origin has been obtained consistently by short exposures of affected areas to the application of a magnetic induction device producing short, sharp, magnetic-field pulses of minimal amplitude to initiate the electrochemical phenomenon of electroporation within a 25 cm2 focal area. Treatments are short, fasting-acting, and economical and in many instances have obviated surgery.
This report describes typical cases such as dysmenorrhea, endometriosis, ruptured ovarian cyst, acute lower urinary tract infection, post-operative haematoma, and persistent dyspareunia in which pulsed magnetic field treatment has not, in most cases, been supplemented by analgesic medication. Of 17 female patients presenting with a total of 20 episodes of pelvic pain, of which 11 episodes were acute, seven chronic and two acute as well as chronic, 16 patients representing 18 episodes (90%) experienced marked, even dramatic relief, while two patients representing two episodes reported less than complete pain relief.

**Marks RA et al, (2000)** aimed at identifying the outcomes in discogenic low back pain patients treated with or without PEMF therapy. Sixty-one randomly selected patients who underwent lumbar fusion surgeries for discogenic low back pain between 1987 and 1994 were retrospectively studied. All patients had failed to respond to preoperative conservative treatments. Forty-two patients received adjunctive therapy with pulsed electromagnetic field stimulation, and 19 patients received no electrical stimulation of any kind. Average follow-up time was 15.6 months postoperatively. Fusion succeeded in 97.6% of the PEMF group and in 52.6% of the unstimulated group (P < .001). The observed agreement between clinical and radiographic outcome was 75%. The use of PEMF stimulation enhances bony bridging in lumbar spinal fusions. Successful fusion underlies a good clinical outcome in patients with discogenic low back pain.

**Thomas AW et al, (2001)** Objective: The effect of specific PEMF exposure on pain and anxiety ratings was investigated in two patient populations. Design: A double-blind, randomized, placebo-controlled parallel design was used. Method: The present study investigated the effects of an acute 30 min magnetic field exposure (less than or equal to 400 microTpk; less than 3 kHz) on
pain - McGill Pain Questionnaire, visual analogue scale and anxiety VAS ratings in female rheumatoid arthritis (RA) (n=13; mean age 52 years) and fibromyalgia (FM) patients (n=18; mean age 51 years) who received either the PEMF or sham exposure treatment. Results: A repeated measures analysis revealed a significant pre-post-testing by condition interaction for the MPQ Pain Rating Index total for the RA patients, F(1,11)=5.09, P<0.05, estimate of effect size = 0.32, power = 0.54. A significant pre-post-effect for the same variable was present for the FM patients, F(1,15)=16.2, P<0.01, estimate of effect size = 0.52, power = 0.96. Similar findings were found for MPQ subcomponents and the VAS (pain). There was no significant reduction in VAS anxiety ratings pre- to post-exposure for either the RA or FM patients. Conclusion: These findings provide basic support for the use of PEMF exposure in reducing pain in chronic pain populations and warrants continued investigation into the use of PEMF exposure for short-term pain relief.

Forster PM et al. (2001) conducted a randomized, double-blind, placebo-controlled clinical trial using a low frequency magnetic field in the treatment of musculoskeletal chronic pain. Exposure to a specific pulsed electromagnetic field has been shown to produce analgesic effects in many organisms. In a randomized, double-blind, sham-controlled clinical trial, patients with either chronic generalized pain from fibromyalgia or chronic localized musculoskeletal or inflammatory pain were exposed to a PEMF (400 microT) through a portable device fitted to their head during twice-daily 40 min treatments over seven days. The effect of this PEMF on pain reduction was recorded using a visual analogue scale. A differential effect of PEMF over sham treatment was noticed in patients with FM, which approached statistical significance (P=0.06) despite low numbers (n=17); this effect was not evident in those without FM (P=0.93; n=15). PEMF may be a novel, safe and effective therapeutic tool for use in at least certain subsets of patients with chronic, nonmalignant pain. Clearly, however, a larger randomized, double-blind clinical trial with just FM patients is warranted.
Loizzi P et al, (2002) Aim: Demonstration of analgesic effects of electromagnetic field treatment in cases of chronic refractory pelvic pain. Study Design: Prospective non-controlled trial, 64 women complaining about pelvic pain of at least 6 months duration, resistant to standard therapies, submitted to electromagnetic field applications on both iliac regions by Thelf Systems apparatus by two applications daily lasting 2 hours each for 20-40 days. Control visit after 3 months. Results: Complete subsidence of pain in 39 cases (61%), in 15 patients (23%) relief during treatment, then mild endopelvic tension after a 3-month control; in 10 cases (16%) symptoms reduced only during application hours, unchanged at follow-up. Outcome of treatment appears to be independent of pre-existent psychosocial variables. Conclusion: Magnetic therapy shows a real analgesic effect on pelvic pain, and seems to contribute to resolution of complex interactions between somatic nociceptive stimuli and psychosocial implications affecting pain perception in these patients.

Cole SP et al, (2006) Objective: To determine if a physics-based combination of simultaneous static and time-varying dynamic magnetic field stimulation to the wrist 4 hours/day for 2 months can reduce subjective neuropathic pain and influence objective electrophysiologic parameters of patients with carpal tunnel syndrome. Methods: Randomized, double-blinded, placebo-controlled trial of 36 symptomatic hands. Primary endpoints were visual analog scale and neuropathic pain scale scores at baseline and 2 months and a Patient's Global Impression of Change questionnaire at the end of 2 months. Secondary endpoints were neurologic examination, median nerve distal latencies (compound muscle action potential/sensory nerve action potential), dynamometry, pinch gauge readings, and current perception threshold scores. An "active" device was provided gratis at the end of the study, with 15 subjects voluntarily remaining within the open protocol an additional 2-10 months and using the pre selected primary and secondary parameters. Results: (two months). Of the 31 hands, 25 (13 magnet, 12 sham) had moderate to severe pain (VAS > 4). The VAS and PGIC revealed a non significant pain reduction.
NPS analyses (anova) demonstrated a statistically significant reduction of "deep" pain (35% downward arrow vs 12% upward arrow. \( P = 0.018 \)). NPS Total Composite (decreases of 42% vs 24%, \( P = 0.042 \)), NPS Total Descriptor Score (NPS 8; 43% vs 24%), and NPS 4 (42% vs 11%). Motor strength, CMAP/SNAP, and CPT scores were not significantly changed. Of the 15 hands with up to 10 months of active PEMF exposure, there was objective improvement in nerve conduction (CMAP = 53%, SNAP = 40%, >1 SD), and subjective improvement on examination (40%), pain scores (50%), and PGIC (70%). No detectable changes in motor strength and CPT. Conclusions: PEMF exposure in refractory CTS provides statistically significant short- and long term pain reduction and mild improvement in objective neuronal functions. Neuromodulation appears to influence nociceptive-C and large A-fiber functions, probably through ion/ligand binding.

Taştekin.N et al, (2007) aimed to investigate the efficacy of pulsed electromagnetic field in lateral Epicondylitis comparing the modality with sham PEMF and local steroid injection. Sixty patients with lateral Epicondylitis were randomly and equally distributed into three groups as follows: Group I received PEMF, Group II sham PEMF, and Group III a corticosteroid + anesthetic agent injection. Pain levels during rest, activity, nighttime, resisted wrist dorsiflexion, and forearm supination were investigated with visual analog scale. Pain threshold on elbow was determined with algometer. All patients were evaluated before treatment at the third week and the third month. VAS values during activity and pain levels during resisted wrist dorsiflexion were significantly lower in Group III than Group I at the third week. Group I patients had lower pain during rest, activity and nighttime than Group III at third month. PEMF seems to reduce lateral epicondylitis pain better than sham PEMF and can be used in patients for rapid return to activities.
Pilla AA et al, (2008) - This study reports the use of a portable and disposable noninvasive pulsed electromagnetic field device in a double-blind, randomized, placebo-controlled pilot study. This study was undertaken to determine if PEMF could provide pain control after breast augmentation. Methods: Forty-two healthy females undergoing breast augmentation for aesthetic reasons entered the study. They were separated into three cohorts, one group (n = 14) received bilateral PEMF treatment, the second group (n = 14) received bilateral sham devices, and in the third group (n = 14) one of the breasts had an active device and the other a sham device. A total of 80 breasts were available for final analysis. Postoperative pain data were obtained using a visual analog scale and pain recordings were obtained twice daily through postoperative day 7. Postoperative analgesic medication use was also followed. Results: VAS data showed that pain had decreased in the active cohort by nearly a factor of three times that for the sham cohort by POD 3 (p < 0.001), and persisted at this level to POD 7. Patient use of postoperative pain medication correspondingly also decreased nearly three times faster in the active versus the sham cohorts by POD 3 (p < 0.001). Conclusion: Pulsed electromagnetic field therapy, adjunctive to standard of care, can provide pain control with a noninvasive modality and reduce morbidity due to pain medication after breast augmentation surgery.
REVIEWS ON RELIABILITY OF PAIN ASSESSMENT TOOLS

Ryan KM et al, (1994) studied about the global use of the Brief Pain Inventory. Poorly controlled cancer pain is a significant public health problem throughout the world. There are many barriers that lead to under treatment of cancer pain. One important barrier is inadequate measurement and assessment of pain. To address this problem, the Pain Research Group of the WHO Collaborating Centre for Symptom Evaluation in Cancer Care has developed the Brief Pain Inventory (BPI), a pain assessment tool for use with cancer patients. The BPI is a powerful tool and, having demonstrated both reliability and validity across cultures and languages, is being adopted in many countries for clinical pain assessment, epidemiological studies, and in studies of the effectiveness of pain treatment.


Objectives: The aim of this study was to assess the validity and reliability, and determine the clinical importance, of change on a 0–10 numeric rating scale (NRS) as a patient-rated measure of the perceived severity of spasticity. Methods: Using data from a large, randomized, doubleblind, placebo-controlled study of an endocannabinoid system modulator in patients with multiple sclerosis-related spasticity, we evaluated the test-retest reliability and comparison-based validity of a patient-reported 0-10 NRS measure of spasticity severity with the Ashworth Scale and Spasm Frequency Scale. We estimated the level of change from baseline on the 0–10 NRS spasticity scale that constituted a clinically important difference (CID) and a minimal CID (MCID) as anchored to the patient's global impression of change (PGIC). Results: Data from a total of 189 patients were included in this assessment (114 women, 75 men; mean age, 49.1 years). The test-retest reliability analysis found an interclass correlation coefficient of 0.83 ($P < 0.001$) between 2 measures of the 0–10 NRS spasticity scores recorded over a 7- to 14-day period before randomization. A significant correlation was found between change on 0–10 NRS and change in the Spasm
Frequency Scale \( r = 0.63, P < 0.001 \), and a moderate correlation was found between the change on 0–10 NRS and the PGIC \( r = 0.47, P < 0.001 \). A reduction of 30\% in the spasticity 0–10 NRS score best represented the CID and a change of 18\% the MCID. Conclusions: The measurement of the symptom of spasticity using a patient-rated 0-10 NRS was found to be both reliable and valid. The definitions of CID and MCID will facilitate the use of appropriate responder analyses and help clinicians interpret the significance of future results.

**Keller S et al, (2004)** - Objectives: The Brief Pain Inventory (BPI) is a short, self-administered questionnaire that was developed for use in cancer patients. While most empirical research with the BPI has been in pain of that etiology, the questionnaire is increasingly evident in published studies of patients with non-cancer pain. The current research addresses the need for formal evaluation of the reliability and validity of the BPI for use in non-cancer pain patients. Methods: Approximately 250 patients with arthritis or low back pain (LBP) self-administered a number of generic and condition-specific health status measures (including the BPI) in the clinic of their primary care provider at 2 time points: the initial clinic visit and the first visit following treatment. Results: The reliability of BPI data collected from non-cancer pain patients was comparable to that reported in the literature for cancer patients and sufficient for group-level analyses (coefficient alphas were greater than 0.70). The factor structure of the BPI was replicated in this sample and the relationship of the BPI to generic measures of pain was strong. The BPI exhibited similar relationships to general and condition-specific measures of health as did a generic pain scale (SF-36 Bodily Pain). Finally, the BPI discriminated among levels of condition severity and was sensitive to change in condition over time in arthritis and LBP patients. Discussion: Results support the validity of the BPI as a measure of pain in patients without cancer and, in particular, as a measure of pain for arthritis and LBP patients.
Cleeland C et al, (2005) conducted a study to find out the Reliability and validity of modified Brief Pain Inventory short form in patients with osteoarthritis. The Brief Pain Inventory short form (BPI-sf) is a validated, widely used, self-administered questionnaire developed to assess the severity of pain and the impact of pain on daily functions. A modified version was used daily in randomised control trials of patients with arthritis undergoing treatment with cyclooxygenase-2 specific inhibitors and non-steroidal anti-inflammatory drugs. Results indicate that the modified BPI-sf, much like the original scale, was internally reliable, consistent over time, and had good construct, as well as convergent and predictive validity in assessment of patients suffering from conditions of chronic pain. The modified BPI-sf, like the parent scale, is a valid and reliable tool for situations in which pain is assessed daily and minimizes the burden placed on patients to record information necessary for scientific investigations.

Summary of the Literature

The investigator made a review of related literature which helped to frame the hypotheses and conduct the research in a systematic approach. The reviews were classified and presented under five categories such as; Reviews on Prevalence of Pain in Sportsmen (n=7), Reviews on Multidisciplinary Approach on Pain (n=8), Reviews on Interferential Therapy (n=11), Reviews on TENS (n=8), Reviews on PEMF (n=9), Reviews on Reliability of Pain Assessment tools (n=4).

All the studies reviewed were from authorized and standardized Journals and Websites. The studies presented here proved the effectiveness of the modalities on pain relief. Even though many studies have been done using the selected modalities, there is lack of evidence about the analysis of different components of pain and pain management protocol for sportsmen. So the investigator was more interested to find out these from the present study.