CHAPTER-V

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SUMMARY

Professional cricket is generally considered to have a low injury rate however; the game’s fast bowlers suffer from a high prevalence of lower back injury. In previous studies there are many factors that have been related to back injury. The use of a mixed bowling action, characterized by large counter rotation of the shoulders, is a technique factor that has been repeatedly associated with lower back injury in fast bowlers. Other risk factors for low back injury in fast bowlers include bowling at high speed, having an extended knee when the front foot is in contact with the ground during delivery of the ball and overuse. Injuries need to be properly managed to restrict the possibility of further damage. Overall, the treatment goals in back injuries were pain relief, promotion of healing, decreased inflammation and a return to functional and sports activities as soon as possible with the least side effect. (Dennis, Finch & Farhart, 2005)

The purpose of this experimental pretest-posttest study was to determine the effectiveness of reflexology on self-reported back pain compared to placebo (massage) and control among cricketers. The participants consisted of forty five male cricket players had been training background at least three years, between the age group of 15 and 25 years who were training at the Chandigarh and Mohali cricket stadiums. Participants were randomly assigned to one of three treatments: reflexology, placebo and control. The reflexology group received topical pressure applied to their feet using specific reflex area thought to effect back pain. The placebo group received a foot massage avoiding reflexology area and control group received back pain information.

The participants completed a pretreatment interview back pain experience, and medical history. Pain measures included the 0 to 10 and the SF-MPQ (PPI, VAS, and PRI) pain scales, and OSWESTRY back pain disability questionnaire that were used before and after the treatment. Each treatment (reflexology, massage, and back pain information) was administered for 15 minutes by the researcher in the stadium before their training. A post treatment interview was conducted after one week (7 sessions) at the same condition. Hypothesis testing using multiple regressions found that both reflexology and massage resulted in less pain than providing...
back pain information, and there were significant difference between the reflexology and placebo groups.

After entering the data all statistical analyses were performed using the Statistical Package for Social Sciences (SPSS 17.0). Determine the values for each variable; the following descriptive and inferential statistics were used. The normality of distribution was assessed on all data using the Kolmogorov-Smirnov test. In order to determine the degree of the effect of reflexology on back pain, multiple regressions, the factorial analysis of variance (ANOVA) and the analysis of covariance (ANCOVA) were used to analyze the hypotheses. P-value ≤ .05 was considered to be statistically significant.

FINDINGS

Comprehensively, looking at pretest of disability in each group showed that the back pain disabilities of cricket players were identical and there were no differences between them. The highest difference percentage between pretest and posttest of the back pain disability was seen in reflexology, placebo and control group respectively. But the highest difference percentage for pretest and posttest of back pain disability was for reflexology group with 13.33% and the least was for control group with 3.33%.

Comprehensively, looking at pretest of pain rating index (PRI) in each group, PRI of cricket players were identical and there were no differences between them. The highest difference percentage between pretest and posttest of the PRI was seen in reflexology, placebo and control group respectively. But the highest difference percentage for pretest and posttest of PRI was for reflexology group with 14.23% and the least was for control group with 0.57%.

Comprehensively, looking at pretest of visual analogue scale (VAS) in each group showed that VAS of cricket players was identical and there were no differences between them. The highest difference percentage between pretest and posttest of the VAS was seen in reflexology, placebo and control group respectively. But the highest difference percentage for pretest and posttest of VAS after treatment was for reflexology group with 29.40% and the least was for control group with 5.00%.

Comprehensively, looking at pretest of pain intensity (PPI) in each group showed that the PPI of cricket players were identical and there were no differences between them. The highest
difference percentage between pre-test and post-test of the PPI was seen in reflexology, placebo and control group respectively. But the highest difference percentage for pre-test and post-test of PPI after treatment was for reflexology group with 28% and the least was for control group with 8.00%.

Factorial analysis of variance showed that, there was no relationship between ages, weights, heights and body mass indexes in different groups.

There was no relationship between pre-tests of disability, PRI, VAS and PPI in different groups.

The pre-test back pain disability had a significant relationship with back pain disability post-test and the effects of post-test scores among the groups were significant. \( F_{2,41} = 31.29, p<0.0005 \)

The pre-test pain rating index (PRI) had a significant relationship with PRI post-test and the effects of post-test scores among the groups were significant. \( F_{2,41} = 27.09, p<0.0005 \)

The pre-test Visual analogue scale (VAS) had a significant relationship with VAS post-test and the effects of post-test scores among the groups were significant. \( F_{2,41} = 23.25, p<0.0005 \)

The pre-test pain intensity (PPI) had a significant relationship with PPI post-test and the effects of post-test scores among the groups were significant. \( F_{2,41} = 10.56, p<0.0005 \)

Bonferroni Post Hoc test showed that there was a significance difference between reflexology and Placebo groups. There was a significance difference between reflexology and control groups. There was a significance difference between placebo and control groups. It means that the decrease of pain was effective in reflexology and control groups and also was effective in placebo and control groups. Placebo and control group were effective for the decrease of pain. Comparing the differences between means, the decrease of pain in reflexology was more than placebo group and the Placebo group was more than control group.
Demographics

Forty five cricket players with back pain participated in the study. Despite the fact that in the game of cricket both males and females may participate (Routley and Valuri, 1993), no female cricket players participated in the study. The participant’s age ranged from 15 to 25 years. The mean Body Mass Index (BMI) of the participants in the study placed the majority of the participants in the “normal” categories for adults according to the World Health Organisation (Hanlon et al., 2006). These findings were most likely due to the fact that the majority of participants in the study play cricket usually seven to twelve session per week. The findings on the BMI suggest that the subjects who participated in the study could be classed as elite athletes.

Rationale for Results Differing From Other Studies

This was the first study of the effect of reflexology on self-reported back pain among cricketers, and thus it can open a new knowledge in sport medicine which can help athletes with injuries and pain to return the functional and sports activities as soon as possible, without any side effects. Reflexology has been widely used for variety of health problems since ancient times, but there has been minimal empirical research in the sport field. Many non-pharmacological methods, such as energy therapy and body based practices, need more study of their effects and side effects (Dobbs, 1985)

There were some prior reflexology studies with having a pain outcome (a) a controlled pilot study to examine the duration of pain relief in oncology patients (Stephenson et al., 2003); (b) a quasi-experimental crossover study measured pain and anxiety in breast and lung cancer patients (Stephenson et al., 2000); (c) a controlled study examined MS symptoms, including pain (Joyce & Richardson, 1997); (d) an experimental study of premenstrual distress symptom relief, also include pain (Oleson & Flocco, 1993); and (e) a controlled pilot study of the response of baroreceptors, sinus, arrhythmia, and blood pressure undertaken to determine reflexology’s mechanism of action (Frankel, 1997).

The randomized pilot study (a) with an experimental design to determine the duration of pain relief in oncology patients (N=36) used two 30-minutes reflexology treatments (n=19), each one day apart, compared to a control group(n=17) who received no treatment (Stephenson et al., 2003). After the reflexology treatment, pain was measured using the SF-MPQ, then 3hours later,
then again after the 2nd treatment 24 hours later. After the first treatment there was a significant pain relief effect $F=9.08$, $p=0.01$ with a 2.4 decrease in mean pain scores in the reflexology group, but not at 3 or 24 hours after the 2nd intervention. The present study on the effect of reflexology on back pain had the same decrease in main scores (pretest to posttest) on the PRI portion of the SF-MPQ as the cancer study, although Stephenson et al. (2003) did not have a placebo and control groups and had reflexology administered twice 30 minutes but the present study was done, a week (seven sessions) 15-minute sessions.

The quasi-experimental crossover study (b) measured pain and anxiety in 23 breast and lung cancer patients receiving reflexology or no attention control condition (Stephenson et al., 2000). The patients received one 30-minute reflexology treatment and one 30-minute control time frame 2 days apart with VAS anxiety and SF-MPQ pain measured before and after each condition. Significant group differences were found between the reflexology and control group on anxiety $H= -21.83$, $p= 0.0001$ and pain measured by the PRI of the SF-MPQ $H= 0.41$, $p<0.05$. Similar pain results were obtained in the present study, with an adequate sample size of persons with significant pain (>3) and a different and more homogenous type of pain (self reported back pain vs. cancer pain).

The present study findings, decreased pain when comparing the reflexology group to the control group, were similarly found in the Joyce & Richardson’s (1997) longitudinal study (c). The effect of 12 weekly one-hour sessions of reflexology on MS symptoms showed a 45% symptom improvement in the 14 subjects who received reflexology compared to a 13% symptom improvement in the 13 subjects in the control group. After 6 and 12 weeks of treatment, reflexology provided continued pain relief to some and almost equal numbers experienced worse pain. In contrast to the MS study, this back pain study was done one week 15-minute treatment vs. 12 weekly one-hour treatment, had use of inferential vs. descriptive statistics, control of potentially confounding variables vs. no provision for control. The present study findings plus the results of this study supported the short time pain relief effects of reflexology and the possibility for longitudinal relief, though more research is necessary.

The first experimental study using reflexology (d) was a randomized, placebo-controlled trial in which 38 subjects documented premenstrual symptoms using a 4-point Likert scale on a daily basis for six months (Oleson & Flocco, 1993). A decrease in premenstrual distress (PMD) was found after the use of a combined treatment of ear acupressure, hand, and foot reflexology.
The placebo condition was false ear acupressure and false hand, and foot reflexology, which included stimulation of reflex areas that should not provide PMD relief, such as the elbow, stomach, mouth, or shoulder reflex areas. Repeated measures of ANOVA were used to compare the reflexology group (M= 3.6, SD=1.9) to the placebo group (M= 5.0, SD=2.4) and showed a significant 6 month posttest PMD decrease F= 13.2, p< 0.01 between groups. This study had a decrease in unpleasant symptoms, which is similar to a decrease in pain as was found in this back pain relief study. Although, the current study measured pain only, and the intervention was foot reflexology, not classic ear acupressure points or hand reflexology, both studies indicated symptom relief from reflexolog.

Overall these findings were similar to the other four studies examining reflexology’s effect on pain. This study, as other studies have found reflexology decreases pain when comparing it to a control condition.

Rational for Outcome of Reflexology and Massage on Back Pain

Reflexology and Massage both effectively resulted in less pain in participants with self-reported back pain. It was expected that both would provide pain relief due to the attention, care, and use of touch, although it was hypothesized that reflexology would be more effective. Reasons that reflexology may have not shown more significance is the researcher had to focus more attention to the task of applying reflexology correctly, thus looking at the foot and concentrating on areas vs. being able to freely give attention via nonverbal facial cues with the massage participant. The researcher found it more arduous performing the reflexology, which may have been cues to the participants as the researcher’s hands would tremor when concluding the treatment.

Repeated studies are necessary to conclude the effect of reflexology as equal relief was obtained with a foot massage. One other study has shown benefit when comparing true vs. sham reflexology (Oleson & Flocco, 1993) so further investigation is necessary.

CONCLUSIONS

It is considered that there are areas of the body that have only one or two histological types of receptors, and yet, they are sensitive to variety of different stimuli. The specific area of central nervous system to which afferent nerve fiber pass, determines the type of sensation. For
example, if a pain nerve fiber is stimulated by heat, cold, touch, and pressure, the individual will experience only pain. (Dale, 1984)

**Gating Theory**

Specific neural pathway for specific pain fibers (A delta nerve fibers), travel through the spinothalamic tract towards the central nervous system. When touch and pressure is applied on specific reflex point, it would activate slow conducting C fibers that take the same pathway thereby inhibit the path of a delta nerve fibers and block the pain. According to this theory, pain signals pass through a number of traffic “gates” as they move from the area of injury upwards through the spinal cord to the brain. Like a road or highway, these nerves can handle only a limited number of nerve signals at one time. The pain signals travel slowly. We can generate C fibers through use of Reflexology by applying pressure on a specific reflex point. (Caraceni & Portenoy, 1996)

Reflexology generates competing stimulus of C fibers and effectively blocks the slow pain signals from reading the brain, blocking the pain pathway. The gating theory says that pain impulse can be blocked in the spinal cord by inhibiting signals coming from touch nerve fibers due to this relief in pain. (Caraceni & Portenoy, 1996)

**Reflex Conditioning**

**Stimulus:** Information is sent from the foot to the brain.

**Evaluation:** The brain analyzes the information.

**Response:** After brain responses to the recent information by sending instruction to the entire body about how to adapt.

**Transduction:** It is a process by which one form of energy (the stimuli) is changed to another form of energy (electrochemical energy) of nerve impulse. The stimuli when applied to the receptor, brings about a change potential of the plasma membrane of the nerve ending. Since this process takes place in the receptor, it is referred to as the receptor potential. If the receptor potential is large enough, it generates an action potential. Impulse conduction is simply the movement of action potentials along a nerve cell. (Oden, 1989)

Reflexology was expected to reduce pain through application of direct topical pressure to specific points on the hands or feet thought to correspond to specific somatic organs. In this
study the researcher stimulated areas on the feet believed to correspond to back areas, hormone controlling organs. The back reflex areas stimulated were the spine, neck, hip, knees, and hands. The organs regulating hormones reflex areas stimulated were pituitary, parathyroid, thyroid, testes and adrenals. The helper areas stimulated were the stomach, intestines, and kidneys. The objective of reflexology is not to diagnose, but to maintain or obtain wellness in an individual and part of wellness is pain reduction or relief. (Oden, 1989)

According to the Hsiao’s study, reflexology has positive effects to reduce stress symptom and improve health problems and well-being. By means of appropriate teaching, careful instructions and regular follow-up from reflexology well-experienced persons, people can apply reflexology to themselves for maintaining their health and well-being. (Grace, 2009)

It was expected that massage would be a placebo treatment that would be believed by the participants who received it and who did not know the other treatments that were being compared. The placebo massage intervention was designed not to be used on any of the specific reflexology points on the bottom of the foot; it was a light massage with long strokes on the top of the foot. However, this massage technique also had an effect on self-reported back pain that was similar to reflexology. Examining the effect of reflexology in comparison to massage showed decrease mean pain scores on all pain measures and those in reflexology group had improved pain scores (less pain) on all pain scores.

The post treatment interview of participant’s report of their responses to the treatment indicated that almost all found reflexology moderately to very helpful and nearly all would recommended it to others. However, this was also true with the massage and control group. The study design was effective in making sure that all groups felt that they were receiving a beneficial treatment. None of the participants were queried on their belief if they were receiving the treatment of interest, the placebo, or control. The massage group (like the reflexology group) had a hands-on treatment, which is known to increase relaxation. The control group received back pain information. They found a few relaxing or distracting for pain. Thus the information intervention did not have an immediate effect on pain as reflexology and massage did, but may have a long term effect on pain relief and may have served as an attention control condition and also served as a placebo for both reflexology and massage. This is an area to be investigated in
future studies. None of the participants reported any side effects or adverse reactions during or after the treatments.

Age was tested as a continuous variable and showed non significant differences between groups. Length of disease can change pain quality, for example early in disease, pain may occur with activity and be relieved by rest as the disease progresses, pain can occur at rest. Younger people in this study had higher PRI pain scores which may be due to young people being more distressed about having chronic pain or due to under reporting in older subjects due to the common belief that pain is normal part of aging or that noting can be done to relieve pain. Use of the pain measurement instrument, the SF-MPQ, in this study may have contributed to difference in age related pain reports. two studies examining arthritic pain found the elderly to have lower pain scores on the MPQ and on the PRI scale of the SF-MPQ in both the sensory and affective components (Gagliese & Melzack, 1997).

Overuse injuries

Cricketers, like any athletes today, are expected to train harder and longer, and to commence at an earlier age, if they are to succeed at the elite level. It is, therefore, not surprising that physicians are diagnosing an increasing number of overuse injuries, as the hours of repetitious practice produce a gradual deterioration in the functional capacity of the body. An overuse injury results from an accumulation of stresses to the involved tissue - bone, ligaments or tendons. The tissue and anatomic sites of an overuse injury may vary but according to Herring and Nilson (1987) the cause is still the same: repetitive episodes of trauma overwhelming the body’s ability to repair itself. Once an overuse injury develops, the condition remains until physiological equilibrium is re-established between the stress load and the body’s healing ability (Ting, 1991).

Overuse injuries of the spine

Cricketers can suffer from a range of overuse injuries associated with all aspects of the game including running, throwing, batting and bowling. The most severe overuse injury, particularly for the fast bowler, is the development of abnormal radiological features in the lumbar spine. This is a current concern, with many young and talented bowlers, suffering from back injuries before they reach an elite level. Indeed, Fitch (1987) describes fast bowling as one of the most injury liable non-contact activities in cricket. Overuse injuries amongst fast bowlers
are generally to the lower spine. The fast bowler can suffer from the development of abnormal radiological features in the lumbar spine. They include a range of debilitating and painful damage to the lumbar spine (Elliott et al., 1992).

**Age**

The young cricketer’s discs are relatively elastic and forces are more readily transmitted to the facet joints, placing undue stress on the pars interarticularis. High performance young fast bowlers are more likely to bowl excessively throughout the growth period when the spine is immature. As a result they are more vulnerable to injury as the forces associated with fast bowling are unable to be absorbed. (Hardcastle, 1991) Elliott et al. (1992) found that fast bowlers with no abnormal radiological features were significantly younger than those with spondylolysis, spondylolisthesis or pedicle sclerosis (median age, 16.4 years versus 18.4 years, respectively). This result may be interpreted as an increased incidence of abnormal radiological features with more years spent bowling. In contrast, however, Elliott et al. (1993) investigated 24 young fast bowlers and found no significant differences between those with abnormal radiological features (mean age 14) and those without (mean age 13.5) in terms of any physical capacity measures. Consideration must also be given to increased incidences with increased age as disc degeneration starts during the second decade of life and is known to increase with age (Miller, Schmatz, & Schultz, 1995)

**Rehabilitation**

According to Powell et al. (1986), a previous injury may be more likely to re-occur because the original tissue or the injury may not have healed completely. This leads to the conclusion that complete and controlled rehabilitation of an injury needs to be achieved, and sensible preventive precautions taken, before the person begins to play cricket again. A rehabilitation programme cannot be regarded as having been completed until the athlete is free from pain; muscle strength has returned to about the pre-injury level; and articulatory mobility (joint union movement) has recovered to pre-injury level. (Powell, Kohl, Caspersen, & Blair, 1986)

This experimental study on the effect of reflexology on back pain among cricketers has statistical significance with evidence that back pain is more effectively relieved with foot
reflexology or with foot massage than providing education on back pain management. Use of reflexology and massage supports the gate control theory (Melzack & Wall, 1965). Areas for further research include use of reflexology in other pain populations, examination of proper dosing of reflexology treatments, and how reflexology may alleviate complications of chronic pain. It is also recommended that differences between foot reflexology and foot massage are examined to find the most cost and pain effective treatment. Physical education programs should being with the awareness of reflexology as a potential adjunct to pharmacological methods of pain management. Coaches interested in complementary therapies who are involved with acute or chronic pain patients should be encouraged to obtain training in this ancient, but not well known, yet effective adjunct to pain relief.

**RECOMMENDATIONS**

Overuse injuries are common among cricketers. Based on this review of the literature and discussions with experts, the following recommendations for further research, development and implementation can be made:

- Research is required to determine the maximum effect of other types of massage and compare with reflexology treatment.
- Research is required to determine the effect of reflexology on different sports.
- Research is required to determine the effect of reflexology on different age groups of athletes.
- Research into the mechanisms of action of reflexology to the athlete’s body needs to be conducted.
- Developmental research on the effect of ear reflexology on pain should be undertaken.
- Developmental research on the effect of hand reflexology on pain should be undertaken.
- The role of shoe design (using special pressure) in preventing overuse injuries should be further explored.