Chapter II

REVIEW OF RELATED LITERATURE

A study of relevant literature is an essential step to get fuel picture of what has to be done with regard to this study. Such reviews bring about a deep insight and clear perceptive of the overall field. The review will help the development of research procedure.

The term literature is employed to include anything appropriate to the topic, such as theories, letters, documents, historical records, government reports, newspaper account, empirical studies, and so forth.

Sanja Simek et al., (2007) conducted a study to identify the changes in tests assessing speed-explosiveness abilities after a completed proprioceptive training programme. The research included 75 physically active men divided into the experimental (n=37) and the control (n=38) group. The first group underwent the proprioceptive training programme lasting ten weeks (60 minutes three times a week). The training programme consisted of one-leg and double-leg static and dynamic balance drills. The demands and duration of those exercises increased progressively. The control group continued to carry out their daily activities during the experiment. The explosive jumping strength and agility were estimated by nine tests at the beginning and at the end of the experiment. For each variable the central and dispersion parameters were calculated as well as the as metric feature. The differences between groups’ and time points in certain variables were determined by the repeated measure analysis of variance and the post Hoc Turkey test. The results of this research show that there were positive changes in some analyzed tests due to the proprioceptive training programme. There were some significant changes in the experimental group under the influence of the proprioceptive training programme in double-leg vertical jump explosive strength tests and in forward agility (20Y test). Minor but positive changes point to the possibility of developing motor abilities by means of proprioceptive training, and not only to prevent injuries. This has already been proved in a number of research studies.
Raty, Impivaara and Karppi (2002) conducted a study on the dynamic balance in former elite male athletes and in community control subjects. A better test result (short completion time) was associated with lower body mass index (in both groups), with jumping height and physical activity during the previous year (in former athletes), and with younger age, better general health, and better perceived physical fitness (in control subjects). Test results in former athletes were, on average, comparable to those of 24-30 years younger community control subjects.

Harish et.al, (2002) conducted a study ‘Effect of proprioceptive training with breathing and imagery on performance of gymnast of different age groups’ 32 gymnasts were administered the proprioceptive training and mental imagery training for 12 weeks period. 16 gymnasts involved in proprioceptive training and other 16 gymnasts involved in mental imagery training. Their age range between under 13 years and above 13 years. Balance measured by Bio-desk balance system instrument was used. This study significantly improved the left leg balance and right leg balance of different age groups.

Muaidi et al., (2008) to evaluate the elite athlete’s exhibit enhance proprioceptive acuity, range and strength of knee rotation compared with non-athletes. 18 Olympic level soccer players’ and 18 non-athletes involved in this study. The knee rotatory kinesthetic device was used to present stimuli of different magnitude to determine proprioceptive acuity for internal and external active rotation, and to measure active and passive rotation range of motion. Knee rotation strength was measure using a dynamometer. It was found that proprioceptive acuity of the athletes was significantly better than that of the non-athletes; this findings suggested that highly trained athletes passes enhanced proprioceptive acuity and muscle strength that may be inherent or may develop as a result of long-term athletic training.

To determine whether symmetrical or asymmetrical equilibrium training can enhance the proprioceptive input of the leg versus right supporting leg motor control. Guillow (2006), evaluate the dynamic sensory motor control and symmetrical or asymmetrical equilibrium training. Proprioceptive input was tested using a seesaw platform, and experts in asymmetrical tasks (soccer players) were compared to experts in symmetrical tasks (dancers, acrobats) and untrained subjects according to pitch
versus roll imbalance direction on each SL. The results of this study, the low frequency ban, spectral energy values were lower for experts’ than for untrained subjects in the roll direction only. Regarding high frequency band, spectral energy values were lower for the leg SL compared to the right one for soccer. It was concluded that asymmetrical equilibrium training minimized the proprioceptive input, emphasizing the role of the biomechanical component in postural regulation.

Shields et al., (2001) conducted a study of proprioceptive coordination of movement sequences in human. Nineteen able-bodied subjects were tested on their ability to perform or motor task that involved extension of their leg indeed finger when their left ankle was passively plantar flexed at random velocities through predetermined target angle. It is found that the able bodied subjects were able to adjust their finger responses up to ankle velocities of 70 degrees /s (300ms). The processing time and conduction delay between ankle rotation and index finger was estimated to be approximately 85ms. It was concluded that the nervous system processes kinesthetic input related to joint rotation of the ankle with the central mechanisms to execute a planned coordinated task with the upper extremity.

Lemmink (2010) did an investigation to determine the reliability of two field hockey specific tests: the shuttle sprint and dribble test (Shuttle SDT) and the slalom sprint and dribble test (Slalom SDT). The shuttle sprint and dribble performances of 22 young male and 12 young female field hockey players were assessed on two occasions within 4 weeks. Twenty one young female field hockey players took part in the slalom sprint and dribble test twice in a 4 week period. The Shuttle SDT required the players to perform three 30 m shuttle sprints while carrying a hockey stick alternated with short periods of rest and, after a 5 minute rest, three 30 m shuttle sprints alternated with rest while dribbling a hockey ball. The Slalom SDT required the players to run a slalom course and, after a 5 minute rest, to dribble the same slalom with a hockey ball. There were no differences in mean time scores between the two test sessions. The mean differences were small when compared with the means of both test sessions. With the exception of the slalom sprint time, zero lay within the 95% confidence interval of the mean differences indicating that no bias existed between the two measurements. With the exception of delta shuttle time (0.79), all interclass correlation coefficient values for
the Shuttle SDT, met the criterion for reliability of 0.80. Intra-class correlation coefficient values for Slalom SDT were 0.91 for slalom sprint time, 0.78 for slalom dribble time, and 0.80 for delta slalom time. Shuttle SDT and the Slalom SDT are reliable measures of sprint and dribble performances of young field hockey players.

Panics, et al., (2006) studies have shown that proprioception training can reduce the risk of injuries in pivoting sports, but the mechanism is not clearly understood. To determine the contributing effects of proprioception on knee joint position sense among team handball players. Prospective cohort study. Two professional female handball teams were followed prospectively for the 2005-6 season. 20 players in the intervention team followed a prescribed proprioceptive training programme while 19 players in the control team did not have a specific proprioceptive training programme. The coaches recorded all exposures of the individual players. The location and nature of injuries were recorded. Joint position sense (JPS) was measured by a goniometer on both knees in three angle intervals, testing each angle five times. Assessments were performed before and after the season by the same examiner for both teams. In the intervention team a third assessment was also performed during the season. Complete data were obtained for 15 subjects in the intervention team and 16 in the control team. Absolute error score, error of variation score and SEM were calculated and the results of the intervention and control teams were compared. The proprioception sensory function of the players in the intervention team was significantly improved between the assessments made at the start and the end of the season (mean (SD) absolute error 9.78-8.21 degrees (7.19-6.08 degrees) vs. 3.61-4.04 degrees (3.71-3.20 degrees), p<0.05). No improvement was seen in the sensory function in the control team between the start and the end of the season (mean (SD) absolute error 6.31-6.22 degrees (6.12-3.59 degrees) vs. 6.13-6.69 degrees (7.46-6.49 degrees), p>0.05). This is the first study to show that proprioception training improves the joint position sense in elite female handball players. This may explain the effect of neuromuscular training in reducing the injury rate.

Dohm et al., (2008) conducted a study of each therapy and training program proprioceptive exercises are integrated. A lot of equipment you can buy. But for a more effective training exercises and equipment should be select more regarding the aim and the problem of the training. In literature it is not much written about the specific way
propriodmp equipment stimulate different muscles. In this study 15 students of sport sciences (25.7 +/- 2.2 years, 8 male, 7 female) were tested for a period of 15 seconds in a single-leg standing position on a small rocker board, a wobble board, a gym mat and the Posturomed(c). The exercise was done just one time on each tool in a random way.

The effect of the exercise was measured by EMG on six main stabilizing muscles, m. tibialis ant., m. peroneus long., and m. gastronemius med. And lat., m. semimembranosus and m. vastus med. At the end of the test series MVC of each muscle was tested. For the analysis we regarded the first, middle and last second of the test. Also the maximum peak over 0.5 sec. and the average of the whole test was integrated into the data base. The statistics was done with the Wilcoxon-Test. The experimental standard deviation was defined of 5 %. The highest EMG activity we noticed on the small rocker board. The activity was over the whole test series significant higher in the muscles m. tibialis ant., m. peroneus long and m. gastronemius. The m. semimebranousus shows in all exercises the slightest EMG activity, the m. peroneus long, shows the highest activity. During the test all muscles decrease in EMG activity except m. peroneus long. on the small rocker board and the Posturomed. With these facts of EMG activity during proprioceptive exercises we are able to advice training more specifically: Because of the decreasing activity we advice doing repeated intervals not longer than 15 seconds. In the aim of ankle stabilization use the small rocker board and the gym mat. For rehabilitation and prevention on the knee use the Posturomed, the mat or even the small rocker board. The advocacies are given looking to the tested rehab tools.

Borghuis et al., (2008) conducted a study was to examine the hip musculature is found to be very important in connecting the core to the lower extremities and in transferring forces from and to the core, it is proposed to leave the hip musculature out of consideration when talking about the concept of core stability. A low level of co-contraction of the trunk muscles is important for core stability. It provides a level of stiffness, which gives sufficient stability against minor perturbations. Next to this stiffness, direction-specific muscle reflex responses are also important in providing core stability, particularly when encountering sudden perturbations. It appears that most trunk muscles, both the local and global stabilization system, must work coherently to achieve core stability. The contributions of the various trunk muscles depend on the task being performed. In the search for a precise balance between the amount of
stability and mobility, the role of sensory-motor control is much more important than the role of strength or endurance of the trunk muscles. The CNS creates a stable foundation for movement of the extremities through co-contraction of particular muscles. Appropriate muscle recruitment and timing is extremely important in providing core stability. No clear evidence has been found for a positive relationship between core stability and physical performance and more research in this area is needed. On the other hand, with respect to the relationship between core stability and injury, several studies have found an association between a decreased stability and a higher risk of sustaining a low back or knee injury. Subjects with such injuries have been shown to demonstrate impaired postural control, delayed muscle reflex responses following sudden trunk unloading and abnormal trunk muscle recruitment patterns. In addition, various relationships have been demonstrated between core stability, balance performance and activation characteristics of the trunk muscles. Most importantly, a significant correlation was found between poor balance performance in a sitting balance task and delayed firing of the trunk muscles during sudden perturbation. It was suggested that both phenomena are caused by proprioceptive deficits. The importance of sensory-motor control has implications for the development of measurement and training protocols. It has been shown that challenging proprioceptor during training activities, for example, by making use of unstable surfaces, leads to increased demands on trunk muscles, thereby improving core stability and balance. Various tests to directly or indirectly measure neuromuscular control and coordination have been developed and are discussed in the present article. Sitting balance performance and trunk muscle response times may be good indicators of core stability. In light of this, it would be interesting to quantify core stability using a sitting balance task, for example by making use of accelerometry. Further research is required to develop training programmes and evaluation methods that are suitable for various target groups.

Reimann, V.L. (2010) discussed the role of proprioception in motor control and in activation of the dynamic restraints for functional joint stability. Proprioception is conveyed to all levels of the central nervous system. It serves fundamental roles for optimal motor control and sensor motor control over the dynamic restraints. Although controversy remains over the precise contributions of specific mechanoreceptors, proprioception as a whole is an essential component to controlling activation of the dynamic restraints and motor control. Enhanced muscle stiffness, of which muscle
spindles are a crucial element, is argued to be an important characteristic for dynamic joint stability. Articular mechanoreceptors are attributed instrumental influence over gamma motor neuron activation, and therefore, serve to indirectly influence muscle stiffness. In addition, articular mechanoreceptors appear to influence higher motor center control over the dynamic restraints.

Hazime.F, et al., (2011) examined single Limb Stance under visual and proprioceptive disturbances is largely used in clinical settings in order to improve balance in a wide range of functional disabilities. However, the proper role of vision and proprioception in SLS is not completely understood. The objectives of this study were to test the hypotheses that when ankle proprioception is perturbed, the role of vision in postural control increases according to the difficulty of the standing task. And to test the effect of vision during postural adaptation after withdrawal of the so esthetic perturbation during double and single limb stance. Eleven males were submitted to double (DLS) and single limb (SLS) stances under conditions of normal or reduced vision, both with normal and perturbed proprioception. Center of pressure parameters were analyzed across conditions. Vision had a main effect in SLS, whereas proprioception perturbation showed effects only during DLS. Baseline stability was promptly achieved independently of visual input after proprioception reintegration. In conclusion, the role of vision increases in SLS. After proprioception reintegration, vision does not affect postural recovery. Balance training programs must take that into account.

Dongqing Xu., et al., (2003) to investigate through analyzing the kinematics and muscle activity of a typical Tai Chi (TC) movement—"brush knees and twist steps" (BKTS)—the purpose of this study was to discover whether TC exercise contains training components in proprioception and neuromuscular control. Six TC masters performed BKTS three times. Video filming and electromyographic (EMG) activity of the rectus femoris (R), semitendinosus (S), gastrocnemius (G), and anterior tibialis (T) muscles were synchronously recorded. Throughout the whole movement, the results indicated that the continuous shifting of the center of gravity (CG) and a wide range of motion (ROM) of joints might facilitate the improvement in balance and proprioception. Meanwhile, continuous alteration of muscle loading and types of contraction produced different levels of muscular activity, which was helpful to
develop muscle strength and endurance. The slow and smooth action of the BKTS also required well-controlled muscle coordination. All of these effective training factors for proprioception and neuromuscular control made TC exercise produce particular benefits on postural control.

Kevin McMurday, (2006) conducted a study to determine the relationship between unilateral squat strength and measures of static balance to compare balance performance between the dominant and non-dominant leg. Seventeen apparently healthy men (mean mass 90.5 ± 20.9 kg and age 21.7 ± 1.8 yrs) and 25 women (mean mass 62.2 ± 14.5 kg and age 21.9 ± 1.3 yrs) completed the study. Weight bearing unilateral strength was measured with a 1RM modified unilateral squat on the dominant and non-dominant leg. The students completed the stork stand and wobble board tests to determine static balance on the dominant and non-dominant leg. Maximum time maintained in the stork stand position, on the ball of the foot with the uninvolved foot against the involved knee with hands on the hips, was recorded. Balance was measured with a 15 second wobble board test. No significant correlations were found between the measurements of unilateral balance and strength (r values ranged between -0.05 to 0.2) for the men and women. Time off balance was not significantly different between the subjects’ dominant (men 1.1 ± 0.4 s; women 0.3 ± 0.1 s) and no dominant (men 0.9 ± 0.3 s; women 0.3 ± 0.1 s) leg for the wobble board. Similar results were found for the time balanced during the stork stand test on the dominant (men 26.4 ± 6.3 s; women 24.1 ± 5.6 s) and no dominant (men 26.0 ± 5.7 s; women 21.3 ± 4.1 s) leg. The data indicate that static balance and strength is unrelated in young adult men and women and gains made in one variable after training may not be associated with a change in performance of the other variable. These results also suggest that differences in static balance performance between legs cannot be determined by leg dominance. Similar research is needed to compare contra lateral leg balance in populations who participate in work or sport activities requiring repetitive asymmetrical use. A better understanding of contra lateral balance performance will help practitioners make evaluative decisions during the rehabilitation process.

Blackburn et al., (2000) determined whether proprioception or muscular strength is the dominant factor in balance and joint stability and define what type of ankle rehabilitation is most effective for these purposes. Setting: The University of
North Carolina Sports Medicine Research Laboratory. Subjects: Thirty-two healthy volunteers free of head injury, dominant leg injury, and vestibular deficits. Design: Subjects were divided into control, strength-training, proprioceptive-training, and strength-proprioception combination training groups. Balance was assessed before and after 6-week training programs. Measurements: Static, semi dynamic and dynamic balances were assessed. Results: Subjects showed no improvement for static balance but improved significantly for semi dynamic (P = .038) and dynamic (P = .002) balance. No significant differences were observed between groups. Conclusions: Enhancement of proprioception and muscular strength are equally effective in promoting joint stability and balance maintenance. In addition, no 1 type of training program is superior to another for these purposes.

Zouita Ben Moussa, A. (2010) suggested the relation between the contribution of vision and the expertise level on postural control appears to depend on the sport practiced. The purpose of our work is to analyze the postural control and the use of visual information in soccer players according to their level of competition. Methods: Two groups of healthy soccer players were investigated: an amateur (AM) (n = 16) group composed of regional-level players and a professional group at a national level (PRO) (n = 16). Posture was assessed by measuring the center of gravity velocity (COG) with a force platform "Balance Master®" during a test (30 s) of bipedal and single-leg stance quiet standing posture. Results: The COG velocity was significantly greater in the AM group than in the PRO group with EO and EC. The vision and surface factors engendered significant differences in both the AM and PRO groups (P < 0.05). Indeed, on couple surface EO condition, sway of COG was greater for the AM group than for the PRO group (P < 0.05). Conclusion: The contribution of vision in postural maintenance was less important in the PRO players than in the AM.

Hann , et al., (1999) examined the objective of the present cross-sectional study was to estimate one-leg standing balance in athletes and to investigate the relationship with type and amount of sports activity. The study comprised 339 active, competitive, non-pregnant athletes, aged 14-24 years from two sports clubs in the county of Aarhus, Denmark. The athletes answered a questionnaire about occupation and sports activity. One-leg standing balance was measured as the maximum time of one-legged balancing.
The mean of the maximum time of one-legged balancing was 29 s (interquartile range 11.25-33.5 s). One-leg standing balance was positively associated with years of participation in basketball and was not associated with sex and age. We conclude that participation in basketball may induce significantly adaptive effects on standing balance.

Urton, Maxine Marie et al., (1999) conducted a study was to determine the effects of proprioceptive training on lower leg kinesthetic reaction time. Forty-eight volunteer subjects between the ages of 60 and 90 were matched by age and sex then randomly assigned to the experimental or control group. Fifteen training sessions utilizing the biomechanical ankle platform system were administered over a three week period. The treatment group received half of the training with visual cues and half without visual cues while rotating the periphery of the BAPS hoard clockwise and counterclockwise. During each training period, subjects performed 84 revolutions with each foot. The control group received no training. The hypothesized effects of training on posttest performance were tested with repeated measures statistical procedures. Post hoc analyses (one between and three within repeated measure analyses of variance) were determining the effects of the different choice reaction time protocols and the different for period protocols on any group differences in kinesthetic reaction time improvement.

Matsuda et al., (May 2008) examined the frequency of one-legged stance and two-legged stance differs considerably among sports. We therefore expect the balance ability of athletes from different sports to vary. This study compared the sway characteristics during a static one-legged stance of soccer players, basketball players, swimmers, and non-athletes. The centre of pressure sway during one-legged stance of ten male participants representing each of the four groups was measured using a stabilometer. Centre of pressure sway was assessed by four sway factors: sway velocity, anterior-posterior sway, horizontal sway, and high-frequency sway. None of the four groups of participants showed significant differences in body sway between standing on the dominant leg and standing on the non-dominant leg. The soccer players had more high-frequency sway and less anterior-posterior sway and horizontal sway than the basketball players, swimmers, and non-athletes. These results suggest that soccer players have superior ability to maintain a stable one-legged stance. Further
study is required to determine how much of the superior balance ability in soccer players is innate and how much is developed through training, as well as to determine the relationship between balance ability and playing performance.

Ader, Deborah N. (1995) says that the proprioceptive feedback plays a role in nearly all physical performance, although not all of this feedback is consciously processed. In the areas of sports, music, and biofeedback and self-regulation training, many authors assume that greater sensitivity to body position, orientation, movement, and muscular contractions results in higher levels of skilled physical performance. Yet very little research has been conducted to test individuals' baseline proprioceptive awareness or how various forms of training affect this sensitivity. The aim of this study was to determine the sensitivity of Ss to resting fluctuations in frontalis tension during brief trials of positive/negative imagery, and to discover whether Ss who engage in different forms of daily motor practice (athletic vs. musical vs. no practice) differ in their sensitivity. Subjects generated lists of 15 positive and 15 negative activities/events/environments that were used as foci of 1-minute imagery trials. Health locus of control beliefs were assessed using the Wallston and DeVellis (1978) MHLC scale to investigate whether such beliefs are related to ability to self-monitor. Relaxing in a reclining chair and wired to an EMG monitor via surface electrodes, Ss estimated magnitude of frontalis tension after a 2-minute baseline and after each imagery trial. Within-subjects multiple regressions revealed that most Ss' (73.5%) estimates reflected only the affective valence of the imagery task: if imagery was negative, Ss reported higher tension, if positive, lower tension, regardless of actual frontalis activity. However, 13 Ss' estimates did significantly reflect forehead tension. Thus, Ss can access proprioceptive information, but this information is overshadowed by cognitive/social cues for most people. Type of motor practice was unrelated to magnitude estimation performance in these Ss, as were health locus of control beliefs. Methodological issues concerning magnitude production vs. magnitude estimation and relevance of muscle site are discussed, as are implications of these findings for motor acquisition, performance, and pathology.

Vrije Universiteit Brussel, (2007) conducted the study was to determine the efficacy of a 22-week prescribed sports specific balance training programme on the incidence of lateral ankle sprains in basketball players. A controlled clinical trial was
set up. In total 54 subjects of six teams participated and were assigned to either an intervention (IG) or a control group (CG). The IG performed a prescribed balance training programme on top of their normal training routine, using balance semi-globes. The programme consisted of 4 basketball skills each session and its difficulty was progressively thought-out. The intervention lasted 22 weeks and was performed 3 times a week for 5 to 10 minutes. Efficacy of the intervention on the incidence of lateral ankle sprains was determined by calculating Relative Risks (RR, including their 95% Confidence Intervals or CI) and incidence rates expressed per 1000h. RR (95% CI) showed a significantly lower incidence of lateral ankle sprains in the IG compared to the CG for the total sample (RR= 0.30 [95% CI: 0.11-0.84]) and in men (RR= 0.29 [95% CI: 0.09-0.93]). The difference in RR was not confirmed when examining the incidence rates and their 95% CI’s, which overlapped. The risk for new or recurrent ankle sprains was slightly lower in the IG (new: RR= 0.76 [95% CI: 0.17-3.40] re-injury: RR= 0.21 [95% CI: 0.03-1.44]). Based on these pilot results, the use of balance training is recommended as a routine during basketball activities for the prevention of ankle sprains.

Teixeira et al., (2011) examined the effect of long lasting practice on pedal behavior in sport, we compared experienced adult soccer players and non-soccer players on leg preference in motor tasks requiring general mobilization, soccer related mobilization, and body balance stabilization. We also evaluated performance asymmetry between the right and left legs in static and dynamic unipedal body balance, based on center of pressure displacement, and correlated that with leg preference in balance stabilization tasks. Results revealed (a) a distinct leg preference between mobilization and stabilization tasks, which were significantly different between players and nonplayer’s, (b) similar balance stability between the right and left legs, (c) greater stability of experienced players compared with nonplayer’s in static and dynamic balance, and (d) absence of a significant leg preference correlation with interlateral balance asymmetry. These results suggest an effect of extensive soccer skill practice on establishing leg preference for specific mobilization tasks and overall balance control.

Verniba, Dmitry. (2011) discussed galvanic vestibular stimulation was used to probe the contribution of somatosensory information during balance recovery between elite athletes and healthy controls. Participants underwent a forward lean and release
postural perturbations, where feet-in-place and stepping balance recovery responses were induced. Whole body Center of Mass (COM) and Center of Pressure (COP) excursions were calculated. No difference was found between the groups in peak COM and COP excursions with feet-in-place responses. Athletes demonstrated lower peak COM, but not COP, excursions during stepping. It was found that athletes' trunk angle excursions were also smaller during stepping. Even though athletes did not up-regulate the use of somatosensory system, they demonstrated superior balance recovery ability by maintaining a tighter control of their COM during stepping. The tighter control of COM demonstrated by athletes may be attributed to the superior control of trunk position by maintaining a more erect trunk posture during stepping.

Piegaro, Anthony, B., Jr., Sandrey, Michelle A. (2003) conducted the study was to determine the comparative effects of four-week core stabilization and balance-training programs on semi dynamic and dynamic balance. Subjects were randomly assigned to one of four groups using stratified randomization for gender and activity. These groups included a control group and three experimental groups. Subjects in the three experimental groups performed their training program two days per week for four-weeks. The Biodex Stability System Test (semi dynamic balance) and Star Excursion Balance Test (dynamic balance) were used for pre-test and post-test. There were no significant differences for the Biodex Stability System Test. There were significant main effects for time (medial, posterior, & lateral excursions) and interactions for time X group (posteromedial & anterolateral excursions) for the Star Excursion Balance Test. A combined core stabilization/balance-training program could be used to improve semi dynamic balance, whereas a core stabilization-training program or balance-training program could be used to improve dynamic balance.

Singh, Nabendra. (2010) presented a study which compares the level of motor performance among the categorized skilled hockey players. It delimits the scope of study on Indian universities including Rajasthan University in Jaipur, Maharshi Dayanand Saraswati University (M.D.S) in Ajmer, and Jai Narayan Vyas University in Jodhpur, and on the use of natural grass field to conduct skill tests. It says that this study aims to identify the player's motor performance differences, as well as determine the significance of the identified differences on motor performance components. It
ments the tools used for data collection such as the motor and skill performance variables. Furthermore, it discusses the statistical procedures to be used including analysis of variance, F-test, and Scheffe's post Hock test.

Kiefer, Adam; Riley, Michael A. (2009) discussed postural control typically must be coordinated in a way that is functional with regard to the control of ulterior actions. This entails the formation of coordinative structures that are appropriately flexible and, in general, the incorporation of contributions from the vestibular, visual, and proprioceptive systems. Ballet dancers are known to exhibit heightened proprioceptive awareness and enhanced levels of postural control. However, it is not known if these are related, and the coordination of dancers' body segments during balance has never been examined. The present study utilized a visual tracking task in which participants tracked the forearm motion of a virtual target, by standing on one leg and swaying so as to maintain an equal distance between their head and the target at all times, at frequencies of 0.20 and 0.60 Hz. Mean and SD relative phase between the ankle and hip joints were used to index coordination stability during task performance. Coordination stability during this task is generally believed to depend on proprioceptive coupling of rhythmic excursions about the ankle and hip. A joint-position matching task was used to assess proprioceptive awareness for the ankle, knee, and hip joints of both legs. An eyes-closed, quiet-standing task was also employed. Results showed that the dancers exhibited greater proprioceptive awareness in their lower limbs, and were also less variable in their ankle-hip coordination during the dynamic postural coordination task. Additionally, dancers exhibited lower determinism in the coupling between ankle and hip oscillations than controls. These results demonstrate that dancers are more sensitive to proprioceptive information in their lower limbs, and this may be an underlying mechanism driving their increased coordination stability. Dancers, through training and experience, may have become proficient at optimizing the constraints that enable them to perform complex balance tasks.

Williams et al., (2005) examined age-related differences in the role of visual proportion during a lower limb interceptive action and how this varies as a function of skill and practice. In Experiment 1, skilled and less-skilled 8-, 10-, and 12-year-old boys controlled a soccer ball using heir preferred foot under full vision and when sight
of the effectors was occluded. With the exception of the high-skilled 12-year-olds and low-skilled 8-year-olds, participants showed a decrement in performance when denied access to visual proprioception. In Experiment 2, the effect of practicing under different informational constraints was examined for 12-year-old boys. Children performed varying amounts of practice under full vision, or in a condition where sight of the foot was occluded, before being transferred to the alternative viewing condition. Participants who practiced under occluded viewing conditions showed greater relative improvement in performance over practice and transfer sessions compared with a full vision control group. Some support is provided for the manipulation of visual informational constraints as an effective pedagogical approach to motor learning.

Discussed the contrary to a strict specificity of learning position, Robertson, Elliott, and Starkes (1994) have reported that the balance beam performance of expert gymnasts is less affected by the withdrawal of vision than is the performance of novice gymnasts. In this study, we employed a training paradigm in order to exercise complete control over the sensory conditions under which a dynamic balance beam task was acquired. Novice participants were trained either with or without vision to walk across a balance beam as quickly as possible and later tested in the other vision condition. Although participants improved more in the condition in which they trained, practice in one sensory condition did not negatively affect performance in a different sensory circumstance. The finding that vision was still extremely important after 5 days of practice is problematic for models of motor learning that propose a progression with learning from closed-loop to open-loop control.

Jackson et al., (March 2006) examined attention processes governing skilled motor behavior were examined in two studies. In Experiment 1, field hockey players performed a dribbling task under single-task, dual-task, and skill-focused conditions under both low and high pressure situations. In Experiment 2, skilled soccer players performed a dribbling task under single-task, skill-focused, and process-goal conditions, again under low and high pressure situations. Results replicated recent findings regarding the detrimental effect of skill-focused attention and the facilitative effect of dual-task conditions on skilled performance. In addition, focusing on movement related process goals was found to adversely affect performance. Support for
the predictive validity of the Reinvestment Scale was also found, with high reinvesters displaying greater susceptibility to skill failure under pressure. Results were consistent with explicit monitoring theories of choking and are further discussed in light of the conceptual distinction between explicit monitoring and reinvestment of conscious control.

Fontani et al., (December 2007) tested the effect of imagery in the training of skilled movements; an experiment was designed in which athletes learned a new motor action and trained themselves for a month either by overt action or by mental imagery of the action. The experiment was carried out with 30 male karateka (M age=35 yr., SD= 8.7; M years of practice = 6, SD = 3) instructed to perform an action (Ura-Shuto-Uchi) that they had not previously learned. The athletes were divided into three groups: Untrained (10 subjects who did not perform any training), Action Trained (10 subjects who performed Ura-Shuto-Uchi training daily for 16 minutes), and Mental Imagery (10 subjects who performed mental imagery training of Ura-Shuto-Uchi daily for 16 minutes). The subjects were tested five times, once every 7 days. During each test, they performed a series of 60 motor action trials. In Tests 1, 3, and 5, they also performed a series of 60 mental imagery trials. During the trials, an electroencephalogram (EEG), electromyography (EMG), muscle strength and power, and other physiological parameters were recorded. The results differed by group. Untrained subjects did not show significant effects. In the Action Trained group, training had an effect on reactivity and movement speed, with a reduction of EMG activation and reaction times. Moreover, muscle strength, power, and work increased significantly. The Mental Imagery group showed the same effects on muscle strength, power, and work, but changes in reactivity were not observed. In the Mental Imagery group, the study of Movement Related Brain Macro potentials indicated a progressive modification of the profile of the waves from Test 1 to Test 5 during imagery, showing significant variations of the amplitude of the waves related to the premotor and motor execution periods. Results show that motor imagery can influence muscular abilities such as strength and power and can modify Movement Related Brain Macro potentials, the profile of which potentially could be used to verify the effectiveness of motor imagery training.
Brétigny et al., (2011) done a study was to determine coordination profiles for the field hockey drive. Nine elite female players performed five drives each. They were asked to primarily maximize ball placement accuracy, and secondly to drive with high velocity. An optical motion capture system recorded the displacement of six markers on the joints of the players’ arms as they performed the drives, and a radar gun measured the ball velocity after impact. Spatial, temporal, and velocity variables were then established. Discrete relative phases were also established at ball impact to examine medio-lateral and proximo-distal upper-arms coordination. The high standard deviation values in joint kinematics were indicative of inter-individual variability, i.e. several drive solutions. Cluster analysis was thus used and two profiles among the players were identified. For the two profiles, the global coordination pattern of movement (upper-arm coordination) was in-phase for the right arm, and out-of-phase for the left lead arm, suggesting a segmental sequencing. However, differences were noted on local kinematic parameters which led to the following categorization: the ‘strong group’ for defenders and the ‘temporal-effectiveness group’ for midfielders and forwards. The results support the value of individual analysis to better interpret and contrast the distinct roles of expert players.

Acharya and James (2004) investigated proprioceptive training as a measure of skill improvement among novice badminton players. The test variables incorporated during the experiment were skills test in Badminton (Forehand Overhead Straight Clear, Forehand Straight Drop & Forehand under Arm straight Lob) that was performed in combination with each other in drill form (designed by the investigators). Single Leg Stance Balance Test (Bohannon 1984) and assessment in biodex balance system for limits of stability for both comprehensive and comparative (Bilateral) report in eyes open condition. One-way analysis of variance and t-test showed significant improvement in the skills of clear & lob, and in single leg balance test & in comparative balance test on Biodex Balance System for experimental group respectively. Proprioceptive training is not only for rehabilitation but also for improvement of skills and sport performance.

Scholz et al., (2010) conducted a study on the intent of this thesis is to provide an account of the phenomenology of movement that collapses the distinction between mental and physical without the elimination of the mental. There are two main ways in
which mental and physical converge in this account. First of all, the type of knowledge involved in learning movement skills is a type of nonpropositional knowledge that is literally embodied in the neuromuscular system of the body. Thus the mental phenomena of knowing-how and thinking how to do movement skills are body-wide phenomena. Furthermore, this type of knowledge is genuinely self-referential, since the knower and known are identical. Second, the phenomenology of self-actuated movement reveals that the self is experienced as a psychophysical unity through the experience of the coherence of action and the proprioception of that action. This is due to the sense of effort provided by sensorimotor integration of the peripheral neuromuscular system. This sense of effort is the direct awareness of physical properties of muscle lengths, tensions, and speeds of contraction, and is thus a genuine psychophysical phenomenon. It is also argued that we enjoy a high degree of epistemic security regarding experiences of this type.

Resch, Jacob E et al., (2011) ensured that concussed athletes return to play safely; we need better methods of measuring concussion severity and monitoring concussion resolution. To develop a dual-task model that assesses postural stability and cognitive processing in concussed athletes. Twenty healthy, college-aged students (10 men, 10 women; age = 20 ± 1.86 years, height = 173 ± 4.10 cm, mass = 71.83 ± 35.77 kg). Intervention(s): Participants were tested individually in 2 sessions separated by 2 days. In one session, a balance task and a cognitive task were performed separately. In the other session, the balance and cognitive tasks were performed concurrently. The balance task consisted of 6 conditions of the Sensory Organization Test performed on the NeuroCom Smart Balance Master. The cognitive task consisted of an auditory switch task (3 trials per condition, 60 seconds per trial). Main Outcome Measure(s): For the balance test, scores for each Sensory Organization Test condition; the visual, vestibular, somatosensory, and visual-conflict subscores and the composite balance score were calculated. For the cognitive task, response time and accuracy were measured. Balance improved during 2 dual-task conditions: fixed support and fixed visual reference (t<sub>18</sub> = −2.34, P < .05) and fixed support and sway visual reference (t<sub>18</sub> = −2.72, P = .014). Participants' response times were longer (F<sub>1, 18</sub> = 67.77, P < .001, η<sup>2</sup> = 0.79) and choice errors were more numerous under dual-task conditions than under single-task conditions (F<sub>1</sub>,
However, differences were observed only during category-switch trials. Balance was either maintained or improved under dual-task conditions. Thus, postural control took priority over cognitive processing when the tasks were performed concurrently. Furthermore, dual-task conditions can isolate specific mental processes that may be useful for evaluating concussed individuals.

Xu, Yixing et al., (2010) determined the Eye position signals are ubiquitous in the monkey cerebral cortex. These signals arise either from oculomotor proprioception, a feedback signal from the extraocular muscles, or corollary discharge, a copy of the eye motor command. Proprioception provides the eye position signal in area 3a of somatosensory cortex (Wang et al., 2007) and plays a role in calibrating the oculomotor system for accurate eye movements (Lewis et al., 2001). Corollary discharge is presumed to modulate the visual responses of neurons (the 'gain fields') in the lateral intraparietal area (LIP) (Andersen and Mountcastle, 1983), which provides a mechanism for visual and oculomotor processes that occur around the time of a saccade, such as maintaining an accurate representation of saccade target locations in space (Zipser and Andersen, 1988). In this body of work, we study the time courses of eye position modulated responses in area 3a and LIP, to test if these signals can subserve the cortical functions that experimental and computational neuroscientists have ascribed to them. We show that eye position activity in area 3a lags eye position by 60 ms, which is slow and well suited for a calibratory function. We also show that the gain fields in LIP lag the area 3a eye position signal and are inaccurate for at least 150 ms after a saccade. This result suggests that LIP gain fields may derive their eye position input from proprioception, rather than corollary discharge, and are too slow to calculate target locations for action online. These findings further the understanding of the role of eye position signals in the brain and their contributions to cortical processing for accurate saccades to visual targets.

Hamman, R., et al., (1995) conducted a growing popularity and success rate of balance rehabilitation programs, and this success is paralleled by the growth of technology, making available instruments that provide objective, quantitative, and immediate results. The Balance Master(TM) is such a commercially available
instrument, consisting of a dual-force platform connected to a microcomputer that provides visual feedback of the centre of gravity (COG) in relation to the theoretical limits of stability. Spontaneous body sway can be measured in a static central position, or in peripheral positions around the limits of stability (peripheral sway area). The trajectory between targets can also be analyzed in terms of time (transition time) and accuracy (path error) of transition, which gives a quantitative measure of dynamic movement of the COG. This study examined the practice effect that occurs while using this instrument over repeated sessions for two schedules of training (daily and weekly) and over two age groups (20-35 years, and 60-75 years). Each group completed a series of postural exercises, with an assessment of static and dynamic postural variables before and after training, and at approximately 3 and 6 weeks post training. Spontaneous body sway was measured with eyes open, eyes closed, and with visual feedback of the COG. No significant changes were observed in these variables as measured over the four standard assessment occasions. Peripheral sway area and path error decreased significantly for both the daily and weekly training groups from pre- to post-training, and these skills were retained over both retention tests, whereas the tendency toward decreasing transition time was not significant. There were no significant differences between the daily and the weekly training groups. For the elderly group, transition time was the variable with the largest improvement, while path error and peripheral sway area exhibited no significant change. These results identify task-specific training effects with repeated practice for a normal population. Also, variables introduced by the Balance Master system are novel, and these results help to determine which of these measures change with practice. This varies with age. These identified differences may be relevant to the tendency of older healthy people to fall.

Penalba Acitores et al., (2008) examined the role of the body on the cognitive processes involved in Music Performance. The body is involved not only in sound production actions, but in other internal embodiment as well. A model is proposed based on three cognitive theories: Mark Johnson's Embodied Mind Theory, Gibson's Ecological Approach to visual perception and O’Regan and Noë's Sensorimotor Contingencies Theory. The proposed model includes four levels of body participation: (1) prior motor programming, which is necessary for the execution of an action. Our
nervous system is responsible for planning conscious and unconscious movements. (2) Motor execution, which is required to produce the sound of the instrument. Movements are controlled by proprioception. (3) Action, which is also involved in perception. In order to perceive properly it is necessary to be aware of those self movements undertaken by the perceiver. (4) Storage, our memory can store feelings and bodily reactions and draw on them in forthcoming experiences. As a central topic in this research, the role of proprioception will demonstrate a connection between the body and the performer's experience. The aim of the research is to understand the body's participation in different instrumental performances. Three types of instruments are analyzed: acoustic instruments, hyper instruments, and alternate controllers. Hyper instruments constitute acoustic instruments extended by the addition of sensors, whereas, alternate controllers are digital instruments that do not have any resemblance with any acoustic instrument, neither in the shape, nor in the sound. Conclusions highlight a different bodily process for each type of instrument. Acoustic instruments use sound-focused performance. Hyper instruments use both, sound-focused and gesture-focused performances. Alternate controllers use both types of processes in addition to a third one called contingency-focusing process. This third type implies the shifting from the creation of sound through gesture to the movement caused by sound as a consequence of interactivity.

Carre, M.J et al., (2007) examined study sought to apply the semantic differential approach of human perception analysis to measure hockey players' emotional responses to different hockey sticks in different play situations. Three phases of testing were carried out: The first phase involved players being given a set of sticks with varying physical properties. Players were asked to carry out a set of repeated ball-strikes before rating the sticks using a semantic differential questionnaire. The second phase of testing involved repeating the ball-strike study, but with the players' vision of the ball's post-hit behavior being impaired. This was carried out to assess the need for visual cues in assessing stick performance (e.g. power and accuracy). The final phase of testing involved player perception of dribbling performance and used a different set of disguised sticks, including some with mass-distributions that had been altered. The key findings were that players associate a heavy stick with a mass-distribution concentrated towards the head-end as being well suited to hitting. However, for dribbling, players
prefer a stick with a centre of mass higher up the handle. Interestingly, visual cues of post-hit ball behavior made little difference to a player's ability to judge power and accuracy. Results from these studies have been incorporated into an all-encompassing design methodology for sports equipment.

Sunderland, C et al.,(2006) conducted a study an test retest reliability is essential in tests used for both scientific research and to monitor athletic performance. Thirty-nine (20 male and 19 female) well-trained university field hockey players volunteered to participate in the study. The reliability of the in house designed test was determined by repeating the test (3-14 days later) following full familiarization. The validity was assessed by comparing coaches’ ranks of players with ranked performance on the skill test. The mean difference and confidence limits in overall skill test performance was 0.0 ± 1.0% and the standard error (confidence limits) was 2.1% (1.7 to 2.8%). The mean difference and confidence limits for the "decision making" time was 0.0 ± 1.0% and the standard error (confidence limits) was 4.5% (3.6 to 6.2%). The validity correlation (Pearson) was r = 0.83 and r = 0.73 for female players and r = 0.61 and r = 0.70 for male players for overall time and "decision making" time respectively. We conclude that the field hockey skill test is a reliable measure of skill performance and that it is valid as a predictor of coach-assessed hockey performance, but the validity is greater for female players.

Gollhofer, A. (2006), suggested that the mechanical importance of enhanced afferent amins in the neuromuscular control seems to reflect the changed ability of the neuromuscular system to activate the muscles more efficiently at the onset of force development. And proprioceptive training programs may be an efficient tool to improve the agonist/antagonist intramuscular communication. This may have functional importance in all sport disciplines with explosive power demands. The physiological point of view, muscle spindle afferents are not simply stereotype responses to unexpected stretches. Embedded in the neuromuscular pattern they provide high stiffness in the tendomuscular system not only in the ssc. Moreover, they are highly efficient in the isometric force development.

Katherine et al., (2010), examined this research seeks to ascertain the relative value of visual and proprioceptive motion feedback during forebased control of a non-
self entity like a powered prosthesis. Accurately controlling such a device is very
difficult when the operator cannot see or feel the movement that results from applied
forces. As an analogy to prosthesis use, we tested the relative importance of visual and
proprioceptive motion feedback during targeted force-based movement. Thirteen
human subjects performed a virtual finger-pointing task in which the virtual finger’s
velocity was always programmed to be directly proportional to the MCP joint torque
applied by the subject’s right index finger. During successive repetitions of the pointing
task, the system conveyed the virtual finger’s motion to the user through four
combinations of graphical display (vision) and finger movement (proprioception).
Success rate, speed, and qualitative ease of use were recorded, and visual motion
feedback was found to increase all three performance measures. Proprioceptive motion
feedback significantly improves human control of targeted movement in both sighted
and unsighted conditions, supporting the pursuit of artificial proprioception for
prosthetics and underscoring the importance of motion feedback for other force-
controlled human-machine systems, such as interactive virtual environments and
teleoperators.