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Prevention and Movements Analysis of Anterior Cruciate Ligament Partial Rupture by Using Fifa 11+ For Amateur Adult Male Soccer Player

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Abstract

Introduction: Sports participation often lead to a wide range of injuries like fractures, muscle and ligament sprains, central nervous system dysfunction, internal organ damage, or concussion. The effect of ACL injuries is mostly reduced functional performance, joint effusion, muscle weakness, or change in movement. The human body has intrinsic ability to defend itself by instinct, but it is imperative especially in sports to train the body to be more effective in resisting injuries through the exploitation of the body's natural defense mechanisms. The FIFA 11+ program aims at doing this some studies have shown that players who performed the FIFA+ routine regularly had 30-50% fewer sports injuries.

Aim: is to reach a stable balanced knee through proprioception stimulation by applying FIFA 11+.

Method: Validation and reliability for gait and stance analysis performed with Force distribution measurement system (FDM-T) developed by (Zebris Medical GmbH), FIFA 11+ programs presented 10 weeks in row three times per week for 20 minute (P, ACL). Visual Analogue Scale (VAS); 0-10.
Results: (P, ACL) didn't reach stable balanced on the effected knee but gained more self-assured toward his injury.
Conclusion: The study shown that there was not significant relationship in the ACL partial tear injury of the patient and are not sure that proprioceptive was regained, but the patient could return to his activity with self-assured toward his injury also given that good prevention training make functional satisfactory effect possible after ACL partial tear and from the results of this study still need more studies.

Keywords

Sports injuries; Neuromuscular; Anterior cruciate ligament injury; Pain

Abbreviations

ACL: Anterior Cruciate Ligament Injury; VAS: Visual Analogue Scale

1. Introduction

Sports injuries are injuries that occur during participation in athletic games, sporting activities or exercise, which affect athletes of all ages at all levels of performance [1]. Sports participation often leads to a wide range of injuries like fractures, muscle, ligament sprains, central nervous system dysfunction, internal organ damage, or concussion [2]. As Wood & Bellis [2] opined, these injuries are mostly caused by impact or trauma but could also be the effect of overuse of ligaments, muscles and tendons. Sports injuries could pose a serious threat to athletes as it can in fact result in an abrupt end in sports career [3]. In the United Kingdom, approximately 80,000 to 85,000 fractures occur due to participation in sporting activities [4]. In the United States, more than 10 million sports injuries are treated every year [5]. In Scotland, 13% of all fractures seen over a one-year period were sports related. Although these injuries were sustained beyond playing 41 different sports, almost 60% were gained through playing football or rugby [4].

In sports, injury can occur in any part of the body-depending on the type of sporting activity but injuries to the knees are the most frequent musculoskeletal system problems after back complaints s about 48 per 1,000 people are affected by knee injuries in a year [6]. In some of these knee injury cases, one or more of the four knee ligaments is damaged [6]. The knee ligaments prevent abnormal motion by connecting the shinbone and thighbones, and correspondingly brace the knee joint [7]. Where the anterior cruciate ligament (ACL) is the most commonly injured of the injuries to the knee ligaments [6]. Injury to the ACL, according to Kiapour & Murray [8], is one of the most destroyed and frequent injuries of the knee as a result of participation in sports. ACL has an estimated prevalence of one in 3000 in the United States, which implies more than 120,000 cases annually [9]. ACL injury incidence is not common among the general population but it affects young, active individuals, and females more frequently at a

reported two to ten- fold higher risk than males participating in the same sport [10]. High risk of injury together with the high rate of participation in sports among girls and young women over the last three decades has also led to speeded rise in ACL injuries in females [8].

The human body has intrinsic ability to defend itself by instinct, but it is imperative especially in sports to train the body to be more effective in resisting injuries through the exploitation of the body's natural defense mechanisms [11]. The FIFA 11+ programme aims at doing this. Studies have shown that players who performed the FIFA+ routine regularly had 30-50% fewer sports injuries [11]. The FIFA 11+ is a structured exercise programme that not only enhances the prevention of injuries during competitive sporting activity in soccer, but also ensures the compliance of soccer coaches and players [12]. The aim of the FIFA 11+ programme meant for soccer players to make their bodies resistant to injuries by training them to utilize the inherent natural defense mechanisms [11].

Soccer is the most popular team sport in the world [12]. The numbers of registered soccer players are more than 265 million (and increasing) (FIFA, FIFA big count 2006: 270 million people active in football, 2007). However, there are significant risks of sport-related injuries attached to soccer participation; affecting both male and female participants [13,14]. The most common injuries in soccer are knee and ankle ligament injuries, and thigh muscle strains (13,15]. According to Bjordal et al [16] and Powell & Barber-Foss [17], females may be a higher risk of more severe injury than men as the rate of ACL injuries is about three to five times higher for females than for males. The high incidence rate of injury in soccer makes up substantial problems for the players, the clubs, and given how popular the sport is, for society at large [12]. As Lohmander et al [18] and Von Porat et al [19] purported in separate studies, health consequences of ACL injuries are not just in the short term but also in the monumental increase in the risk of early osteoarthritis.

Despite the urgent need to develop programmes to prevent ankle and knee injuries in footballers, there exist only a few small or non- randomized studies on prevention of injury in soccer players, especially in female soccer [12]. Prevention of ACL rupture should be preferred to going through the risks of the effect of ACL injuries on athletes' sports career. Athletes to heighten safer movement patterns that reduce injury risk during sports activities can assume a structured neuromuscular training pre-program. In this way, injury is prevented and sports participation becomes safer.Though there are methods of treating sport injuries, prevention of ACL rupture in soccer can save a lot of problem the athletes face. This study aims at reviewing prevention and movement analysis of anterior cruciate ligament rupture by using FIFA 11+ for soccer amateur adult players with focusing on partial ACL injury.

The specific objectives are to:

1. Review the different ACL injury prevention programmes on soccer?
2. Analyse ACL injuries and FIFA 11+ effectiveness at partial ACL injury through biomechanical measurement (gait, running, stance)?
3. Determine if there is a significant relationship between FIFA 11+ and the prevention of ACL rupture?

2. Theory Background (Literature Review)

2.1 Sport injury

In an estimated injury statistic from the Consumer Product Safety Commission in 2009, children between the ages of 5 and 14 experience significant injuries in various sports [20]. The statistics is as follows [20]:

1. **Basketball:** More than 170,000 kids ages 5 to 14 were treated in hospital emergency sections for basketball-related injuries.
2. **Baseball and softball:** Nearly 110,000 kids ages 5 to 14 were treated in hospital emergency sections for baseball-related injuries. Baseball also has the highest fatality rate in company with sports for children ages 5 to 14, with three to four kids dying from baseball injuries each year.
3. **Bicycling:** More than 200,000 kids ages 5 to 14 were treated in hospital emergency rooms for bicycle-related injuries.
4. **Football:** Almost 215,000 kids ages 5 to 14 were treated in hospital emergency rooms for football-related injuries.
5. **Ice hockey:** More than 20,000 kids ages 5 to 14 were treated in hospital emergency rooms for ice hockey-related injuries.
6. **In-line and roller skating:** More than 47,000 kids ages 5 to 14 were treated in hospital emergency rooms for in-line skating-related injuries.
7. **Skateboarding:** For skateboarding-related injuries more than 66,000 kids age 5 to 14 were treated in hospital emergency rooms.
8. **Sledding or toboggan:** More than 16,000 kids ages 5 to 14 were treated in hospital emergency rooms for sledding injuries.
9. **Snowboarding or skiing:** For snowboarding and skiing injuries more than 25,000 kids ages 5 to 14 were treated in hospital emergency sections.
10. **Trampolines:** About 65,000 children ages 14 and under were having interventions in hospital emergency rooms for trampoline accidents.
11. **Soccer:** About 88,000 kids ages 5 to 14 were treated in hospital emergency rooms for soccer injuries.

2.2 Classification of sport injury

There are two classifications for sports injuries. Sports injuries can be classified according to one of these; the type of body tissue destroyed or the cause of the injury [21]. If injuries are classified according to cause, the three categories are direct injury, overuse injury and indirect injury. If injuries are classified according to the type of body tissue destroyed, the two categories are hard-tissue injury and soft-tissue injury [21].

2.2.1 Classification by cause

- **Direct injury**

  A direct injury is caused by an external force or blow. These types of injuries can be caused by a clash with another person (for example, during a tackle in rugby union) or being hit with an object (for example, a hockey stick or cricket ball). Examples of injuries that result from external forces include hematomas ('corks') and bruises, ligament and joint damage, dislocations and fractures of the bone [21].

- **Indirect injury**

  An indirect injury can occur in two ways:

  i. The actual injury can occur some distance from the impact place. For example, dropping out on an outstretched hand can result in a dislocated shoulder.

  ii. The injury does not happen from physical contact with a person or object, but from internal forces combined by the actions of the performer, such as may be caused by poor technique, over-stretching, fatigue and poorness of fitness. Ligament torsions and muscle strains and tears are examples of these injuries.

- **Overuse injury**

  Overuse injuries occur when repetitive and excessive force is placed on the bones and other connective tissues of the body. No pain or little maybe experienced in the early stages of these injuries and the athlete might keep placing pressure on the injured site. This can prevent the site being given the necessary time to heal. Eventually the damage accumulates, and the injured place becomes inflamed, and therefore painful. The symptoms of overuse injury (Table I) often occur when there is a swing in training practices (such as high training frequency or intensity), and the body can't deal with the new stresses that are placed immediately. A large number of overuse injuries created from poorly guided training programs in which the athlete is not waiting enough time to recover between intense sessions. Some other reasons of overuse injury are practice of poor technique and indigent equipment. Players who practice and contend using poor technique or equipment place on their body extra stress. Instances of this involve elbow injury from poor backhand technique or the practice of a weighty racquet in tennis, and ankle or knee pain from an unfortunate running style or from wearing inadvisable footwear. Examples of injuries that outcome from repetitive forces are stress fractures (little small cracks in the bone) and tendonitis (inflammation of a tendon) [21] (Table 1).

Injury	Symptoms and Signs	Possible Causes
Shin soreness	Tenderness Pain in shins Pain increases by running and jumping Swelling	Increased activity Poor footwear Postural imbalance Muscle imbalance
Knee pain	Pain around knee Pain increased by sport, stairs, sitting, hills Swelling Discolouration	Increased activity Postural imbalance Poor footwear Muscle imbalance Growth spurt
Heel pain	Tenderness over heel Pain increased by running, jumping	Tight calf muscles Growth spurt Poor footwear
Shoulder pain	Pain on certain movements Reduced movement Local tenderness	Increased activity, e.g. swimming Poor technique, e.g. swimming, pitching, serving
Elbow pain	Pain in and around elbow Pain increased by certain activities, e.g. shaking, lifting, gripping	Jarring Increased activity e.g. golf, tennis Muscle imbalance Poor technique Change of grip Lack of control

Table 1: Overuse injuries [21].

2.3 Anterior cruciate ligament injury

Anterior Cruciate Ligament Injury (ACL) is a tear in one of the knee ligaments that joins the upper leg bone with the lower leg bone. Injuries range from mild (partial), such as a small tear, to severe (total rupture), such as when the ligament tears totally or when the ligament and bit of the bone separate from the rest of the bone. Almost half of all injuries to the anterior cruciate ligament happen along with destroyed to other structures in the knee, such as other ligaments, articular cartilage, or meniscus. Injured ligaments are considered "sprains" and are graded on a severity scale [22] (Figure 1).

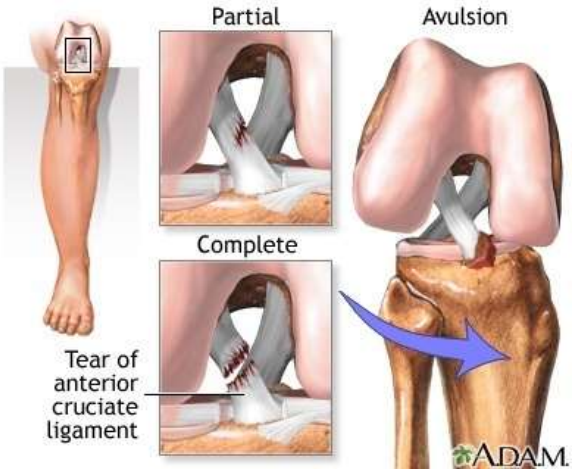

Figure 1: Anterior cruciate ligament [22].

Anterior cruciate ligament injuries are thought to occur due to unsuccessful postural correction and abnormal dynamic loading, i.e., inter-segmental loads in the knee joint [23]. The majority of the ACL injuries (about 70%) occur in a non-contact conjuncture [23]. Non-contact injuries often happen with the knee close to extension during a sudden landing motion or deceleration. Contact injuries are frequently the outcome a contact blow to the lateral part of the knee or leg, a motion that causes a valgus collapse [24]. The injury mechanism for ACL injuries in female team handball is reported to be a forceful valgus collapse with the knee nearly to full extension combined with external or internal tibial rotation [24]. Associated injuries in the capsule, ligament or menisci are common, and most patients have complex injuries [25]. ACL injury is caused when the knee joint is straightened beyond its normal limits (hyper extended), bent backward, twisted, or bent side to side. The chance of injury is higher if more than one of these movements happens at the same time. Tackle (being hit by another person or object) also can cause an ACL injury [22].

Typical circumstances that can be indication to ACL injuries include:

- Changing direction rapidly or passing around an obstacle or another player with one foot solidly planted on the ground. This can happen in sports that put high work on the ACL, such as basketball, football, soccer, skiing, and gymnastics.
- Landing after a jump with an immediate slowing down, especially if the leg is straight or slightly bent (such as in basketball).
- Falling off a stepladder, stepping off an edge, jumping from a moderate or extreme height, missing a step when walking down a staircase, or stepping into a hole. Like these injuries tend to be caused by stopping unexpectedly, with the leg straight or slightly bent.
- People whom inactive and some older adults who have tenuous leg muscles may injure their knees during normal daily activities. In spite they usually injure bones, not ligaments. When contact makes an ACL injury, it can be from playing a sport, from a severe and unexpected accident, or from less obvious contact injuries.

- During sports, ACL injury can happen when the foot is promptly planted on the ground and a sudden force hits the knee while the leg is straight or slightly bent. This can happen when a person is changing direction rapidly, slowing down when running, or landing from a bound. This type of injury is common in soccer, skiing, football, and other sports with lots of stop-and-go movements, bounding (jumping), or swinging. Falling off a ladder or missing a step on a staircase are other likely reasons. Similar to any other body part, the ACL turn out to be weaker with age. Therefore, a tear occurs more effortlessly in people ager than 40 [22].

2.4 Prevention methods in sports injuries

Sports injuries can be prevented when factors that increase their risk is addressed [2]. General sport injury prevention guidelines as outlined by Burger & Fine [26] are as follows:

1. Have a pre-season physical examination and follow what doctors' recommendations say.
2. Use well-fitting cleats and shin guards – there is some evidence that melded and multi-studded cleats are safer than nails-in cleats.
3. Be conscious of poor ground conditions that can escalate injury rates.
4. Use suitable sized synthetic balls-leather balls that can become waterlogged and heavy are more dangerous, especially when bunts them.
5. Watch out for goalposts that can fall on players and request fixed goalposts whenever possible.
6. Hydrate (drinking fluids) adequately-never waited until you are thirsty is often too late to hydrate properly.
7. Pay attention to environmental recommendations, especially in relation to highly hot and humid weather, to help avoid heat illness.
8. Maintain suitable fitness- injury rates are more in athletes who have not adequately prepared physically.
9. After a period of inactivity, progression must be gradually back to full-contact soccer through activities such as aerobic conditioning, strength training, agility and balance training.
10. Avoid overuse injuries-more is not always better. Many sports medicine specialists say that it is beneficial to take at least one season off each year. Try to avoid the pressure that is now exerted on many young athletes to over-exercise. Feel your body and cutback training time and intensity if pain or discomfort arises. This will lessen the threat of injury and help evade "burn-out".
11. Speak with a sports medicine professional or athletic trainer if you have any interest about injuries or prevention strategies.

Keeping safe when participating in sports activities is very important and it starts with taking certain precautions that are most often overlooked. Methods of preventing injuries in sports are:

1. Using safer sports equipment:

Sports Injuries sports can be prevented by making sporting equipment safer [2], especially for amateur players who are still developing sports skills. In the US for instance, the use of softer baseballs has been found to have less injury potential compared to standard balls [27], and have been associated with a 23% reduction in ball-related injuries [28].

2. Using protective equipment:

For definite sports, the procedure of protective equipment can subordinate the threats of experience an injury. These are deliberate either to safeguard against direct blows to the body (e.g. during contact or ball sports) or to maintenance muscles and joints while a person is active. Protective equipment can include: helmet; faceguards; eye goggles; knee, wrist and ankle braces or supports; knee or elbow pads; mouth guards; specialized footwear; and cushioned insoles. Meanwhile the probabilities of injury vary from sport to sport, the effectiveness of protective equipment depends to a large extent on the sport being played; equipment which is protective and effective in one sport may not provide protection during another [2].

3. Standards for protective equipment:

While the use safety equipment can reduce sporting injuries in some instances, the effectiveness depends largely on the quality of the safety equipment itself. Here are British Standards for a wide-ranging mixture of protective equipment, exclusive to certain sports. There has been petite research estimating the influence that these standards have on levels of sporting injuries in the overall population [2]. However, their impact can be substantial. In the US for instance, the introduction of helmet standards for athletic equipment was thought to have contributed (along with changes to the rules of play) to a decrease in serious head injuries among high school football players from 4.25 per 100,000 to 0.68 per 100,000 and fatalities by 74% [29].

4. Changing rules of play:

Sporting injuries can be thwarted through the use of rules that disallow violent or hazardous play, or claim on the use of safety equipment. In certain sports, prevailing rules have been reformed to help avoid some of the more usual and serious injuries practiced [30].For instance, a high incidence of spinal cord injuries in rugby union games led to a change of rules in many countries in the 1980s. This included Britain, where rules were amended for under-19 games relating to the scrum, ruck and maul (where injuries were most likely to be experienced). A study of spinal injuries persistent during rugby in the UK told a deterioration in the number of injuries after the rule changes [31]. Reductions in injuries have been recounted for other sports behind an adjustment in rules of play. For example, in American football, an instruction that forbidden the use of a helmet or faceguard as the primary opinion of interaction when blocking and tackling was applied in the US in 1976 and was assumed to downgrade levels of cervical spine injuries in the sport [32]. Furthermore, in 2000, the World Karate Federation pronounced a change in competition rules, involving stricter policies for making illegal moves (e.g. using disproportionate force or punching prohibited areas of the body). Evaluations of the new rules in Croatia reported little effects on injury rates across all ages but a decrease for those less than 18 years of age [33].

5. Safety guidance or codes of practice

Safety guidance or codes of practice for games are often used to stimulate safe techniques, raiseawareness, and teach about the usage of safety equipment, support fair play, and shield against overuse injuries [2].In the UK, it is a must for every governing toafford safety standards for their sport [34].Habitually, strategies highlight the necessity to: warm up by exercising; stretch once exercising;

increase activity levels and abilityprogressively; dress protective clothing or equipment; escape playing if unwell or under the impact of alcohol; and often check and provide sports equipment. Codes of practice are also used for some sports. For instance, the Alpine Responsibility Code is used in many countries to promote safety practices among skiers, urging them to: take lessons from qualified professional instructors; keep to marked trails; never obstruct a run; avoid skiing under the influence of alcohol or drugs and make sure equipment is in good condition. The use of safety guidelines and codes of practice are important to ensure those involved in sports have the knowledge needed to participate safely and responsibly. However, there is a lack of research evaluating these measures, meaning that little is known about their effectiveness in preventing injuries [2].

6. Warming up and stretching:

Using gentle initial exercises, a warm up is designed to increase the heart rate and temperature, stretch muscles, and mobilize joints in preparation for more vigorous activity. Warm ups are commonly used in many sports and are widely thought to reduce the risks of sustaining an injury. However, their effectiveness is unclear [35].The use of stretching alone (i.e. without any of the additional warm up exercises) has also been evaluated. Results have been miscellaneous, but in general display either insufficient evidence to determine value or limited evidence for them in effectiveness [36].

7. Prevention training programmes:

Training programmes are designed to improve co-ordination, strength and technique, as well as increase awareness of injury risks and prevention strategies. Programmes can include a variety of components, such as: muscle group training; flexibility; weight training; cardiovascular exercise; technique improvement (e.g. how to jump, land or fall safely); and training in the proper use of equipment. Exercise can be offered pre-sporting period only or provided more repeatedly throughout the year. In general, studies of training programmes report moderate, positive effects on the rate of injury[37,38]. Delaying the onset of fatigue during exercise can reduce the risk of injury [39], suggesting that enhanced fitness levels of the athlete will protect against injury during the later stages of matches or training. Specific muscle strength training programmes have been successful in reducing rates of both knee injury [40] and ankle sprains [41]. Programmes are more effective for those students who report a previous injury than those who do not [42]. Despite the positive effects reported, there is a need to control the level of training undertaken, since higher-volume training programmes have been associated with greater severity of injury (e.g. rugby). Since overuse of joints and muscles can be damaging, in some cases, reducing the level of training may actually offer more protection against injury. For instance, reducing the distance, frequency and duration of running during training is thought to be helpful in preventing soft tissue injuries associated with this activity [36].

2.5 FIFA 11+ training programme for soccer

According to the developers of the “The 11+”, it can be considered as a complete warm-up programme whose main goal is to lack the risk of common injuries that are associated with soccer (FIFA, The “11+” Manual: A complete warm-up programme to prevent injuries, 2005). Among the advantages of “The 11+” are the facts that the programme takes only about 15-20 minutes to complete depending on the athletes’ experience with the exercises and with no need for equipment other than a soccer ball.

Another considerable advantage is that the programme can be found in detail by a DVD and other materials to improve even more the understanding of the exercises, such as a technical manual, posters and cards beside videos can be accessed freely through the FIFA website. It is important to highlight that these exercises are old discovered, but they have not become yet routine in training programs. The new form is that these exercises are brought together in a programme that is easy and viable, and could be a standard warm-up before training sessions. Evidently, different studies [12,43,44] have been ordered with the aim of considering the efficiency of the FIFA 11+ warm-up programme in decreasing the number of injuries unceasing by soccer players. Previous evidence indicates over 40% reduction in the risk of injury [45]. Nonetheless, some factors may be associated with the risk of injury during soccer (i.e., competitive level, age, gender, weight). In addition, these injuries might affect different parts of the body and be provoked by different mechanisms of injury, such as traumatic or overuse [45].

This programme is developed in three stages and has an overall of 15 exercises. A really specific sequence needs to be followed and the programme must be performed before every training session.
1. Start with the first stage consists of running exercises by lower displacement speed (i.e., jogging or trotting and slow running 8-10 kmh^{-1}), combined with active stretching briefly (20-30 s) controlled together with colleagues.
2. Then comes second stage include six exercises (with three levels of difficulty each) to the muscle groups of the lower limbs and focus on equation or balance, strength, agility and plyometric exercises (i.e., including high-speed, stretch, shortening cycle exercises, such as hoping and acceleration-deceleration).
3. Finally comes third stage consists of running exercises at moderate and high speed, combined with change of direction [46].

3. Prevention and Movements Analysis of ACL Injury for Amateur Adult Soccer Player by Using FIFA 11+

The aim of the FIFA 11+ programme meant for soccer players to make their bodies resistant to injuries by training them to utilize the inherent natural defense mechanism. The human body has intrinsic ability to defend itself by instinct, but it is imperative especially in sports to train the body to be more effective in resisting injuries through the utilization of the body's natural defense mechanisms [11]. A structured exercise programme that enhances the prevention of injuries during competitive sporting activity in soccer also ensures the compliance of soccer coaches and players that's FIFA 11+ beside the easy understandable and been a common training worldwide [12]. ACL injuries have highest number of player days missed [47]. Also according to Bjordal et al [16] females may be a higher risk of more severe injury than men as the rate of ACL injuries is about three to five times higher for females than for males that's made me too included two of my adult male teammates who play as amateurs once or twice a week. Validation and reliability for gait and stance analysis performed with Force distribution measurement system (FDM-T) developed by (Zebris Medical GmbH).

3.1 Variables

- Stance parameters (figure 2).

*Centre of pressure (COP): is the idea of application of ground reaction forces (GRFs) that reveal the net

force applied to assess and comprehend postural control throughout. For instance, discreet stance and gait, which measure influences or variances linked to age, gender, environmental conditions, health status, etc. COP path length measures the distances covered by the center of pressure as it swings within the base of support.

*Area of Ellipse: it can be formed by the next formula area=Πab. Where a is the inter space from the centre to a vertex; b is the distance from the middle to a co-vertex.

*Body weight distribution between legs (Average forces): average of all the forces or pressure under the feet [48,49].

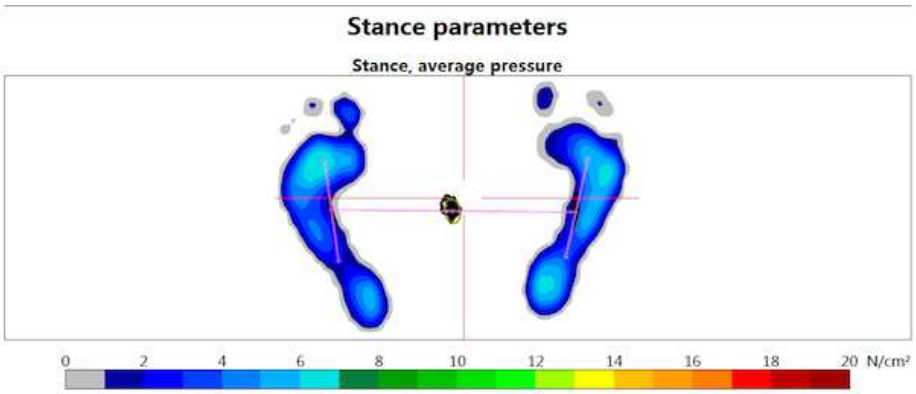

Figure 2: Stance parameters.

- Gait parameters (Figure 3).

1. **Kinematic parameter**

*Stance phase: the total period during which the foot is on the ground.

*Swing phase: applies to the time that foot is in the air for limb advancement.

*Step length: is the interval between initial contacts of each foot.

*Step width: mediolateral space concerning the heels in double support.

*Step time: mediolateral distance time concerning the heels in double support.

*Cadence (steps/mints): the mean adult cadence (men and women) is 110-120 steps/minute

2. **Dynamic parameter:** Maximum forces

The maximum forces that was applied over foot (forefoot-mid foot-heel) during gait cycle [48,49].

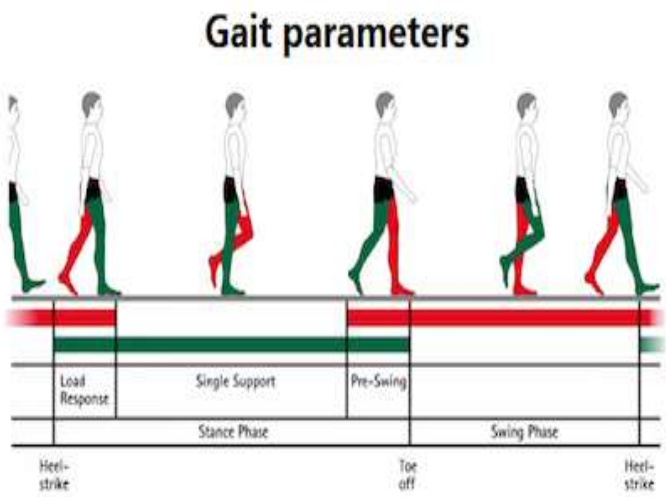

Figure 3: Gait parameters.

3.2 Hypothesis

I had performed FIFA 11+ for a Partial ACL tear injury patient (P, ACL).

H^{01}: I assume that patient (P, ACL) feels more stable his knee after training FIFA 11+ with me on the visual analogue scale (VAS) 0-10. My study went to be in resembling with a better right knee condition for a Healthy patient (H, ACL) plus patient with Total ACL rupture in his right knee (T, ACL) concerning (P, ACL) after applying intervention prevention programme FIFA 11+.

H^{02}: I expect after training we see different parameters before and after FIFA 11+ for (P, ACL):

*__Stance parameters:__

- The COP path length decrease.
- Body disturbance will be equally for both right and left feet.
- Ellipses will decrease.

*__Gait parameter__ (jogging 4kmph in 1 minute):

-Stance phase decrease on left foot.

-Swing phase increase on left foot.

-Step length and width increase for right foot unless step time will remain the same.

-Cadence will decrease.

- Maximum forces on right foot parts will decrease.

*__Gait parameter__ (running 8kmph in 1 minute):

-Stance phase decease on both feet.

-Swing phase increase on both feet.

-Step length decrease, step width and time remain the same unless step time for left feet increase.

-Cadence increase.

- Maximum forces on heel part increase.

H^{03}: I assume after training (P, ACL) will have same similarity parameters to (H, ACL):

***Stance parameters:**

-Body disturbance will be equally for both right and left feet.

***Gait parameters** (jogging 4 kmph in 1 minute):

-Stance phase.

-Swing phase

-Step length, width and time.

-Cadence

- Maximum forces on feet parts for both right and left.

***Gait parameters** (running 8kmph in 1 minute):

-Stance phase: Step length, width and time.

-Cadence.

-Swing phase: Maximum forces on feet parts for both feet.

3.2.1 Examined patients

Injured patient (P, ACL), (T, ACL)

I cross-examined (P, ACL) about how did it happen and the maintenance after his trauma injury he said, "I got injured June 2013 I was playing my favorite sport soccer and while I was tackling with a teammates I performed a sudden twisting motion after a land of jumping with my right knee. I heard a pop sound and my knee started swelling with painful knee and I couldn't perform knee bending and I couldn't land on my right side "and when I asked what doctor told you about your trauma he replied "doctor diagnosis me with a ACL sprain with partial tear 50-70 % of my right knee ACL destroyed "I asked him what doctor did about the symptoms and what was the managements his answers was "doctor palpate my whole knee while he performed knee anterior drawer and meniscus checking test after that a joint aspiration (procedure to remove fluid by using a syringe and needle under a local sedating) were performed and later in a week I had my MRI scan that show ACL partial tear 50-70% . After that procedure my knee bending comes back pain went slightly away and pain too, so he asked me to perform ice and elevation for the effected knee and also strengthening recuts femoris. In addition (P, ACL) is a future physiotherapist and an amateur soccer player he is 23 years old with 79 kilograms. After injury he stops sports activity for 8 weeks and keeps quadriceps strengthening for 6 weeks. On the 8^{th} week after the injury (P, ACL) went back gradually to soccer games which he plays 1-2 times per week.

Total ACL rupture patient (T, ACL) a male soccer amateur player too. He is 22 years old who is already had an ACL total rupture at his right knee. He is going to have ACL replacement surgery also no sports participant at the moment.

Healthy patient (H, ACL)

He is a male amateur soccer player too. He is 21 years old with 82 kilograms without a history of knee injuries or any other kind of injury.

3.3 Methods

On September 2015 I did assessment for validation and reliability gait and stance analysis was hold at the department of physiotherapy in Semmel we is University by Force distribution measurement system (FDM-T) developed by (Zebras Medical GmbH) with all participants performed on treadmill without shoes on. (P, ACL) (Figure 4).I ask the patient to mark on a (VAS) how he self-assured feels the stability of his right knee? Before and after FIFA 11+ training.

Figure 4: VAS marking.

3.3.1 Intervention programme

FIFA 11+ prevention program performed three times per week for 10 weeks (20 minutes) on (P, ACL).
This programme is developed in three stages and has an overall of 15 exercises. A really specific classification and the programme prepared before every training session.

- Start with the first stage consists of running exercises by lower displacement speed (i.e., jogging or trotting and slow running 8-10 km.h-1), combined with active stretching quickly (20-30 s) controlled together with me.
- Then comes second stage include six exercises (with three levels of difficulty each) to the muscle groups of the lower limbs and focus on equation or balance, strength, agility and plyometric exercises (i.e., including high-speed, stretch, shortening cycle exercises, such as hoping and acceleration-deceleration).
- Finally comes third stage consists of running exercises at moderate and high speed, combined with change of direction [46].

4. Results

- **Stance Parameters:**

Show a shift on COP with open eyes 277mm to160mm close eyes 465mm to381mm, Ellipses with open eyes from 497mm^2 to 117mm^2 close eyes 751mm^2 to 287mm^2 and average forces open eyes left 49% right 51% to 49% right 51% left while with close eyes it was 47% left and 53% to equal 50-50% for each right and left.

- **Gait parameters**

(P, ACL) before-after FIFA 11+ gait parameters 4kmph in 1 minute; show shifts at stance phase on load response (12.7% each right and left) and pre-swing (12.7% each right and left) while on mid-stance took more on right 38% than left 36.5%. Swing phase took more on left 38% than right 36.6%. Step length longer left 60cm than right 59cm, step width higher 19cm than before 15 cm; step time was the same before and after 0.54 sec for left and 0.52 sec for right and cadence one step less than before 114 steps/ minuteto 113 steps/minute.

Forces on foot shifts bigger force were on forefoot for both right 786.7N and left 756.1N feet with higher right forefoot after, on mid foot left foot higher 211, 7N and heel also left 434 N was higher. (P, ACL) gait parameters 8kmph in 1 minute; show shifts at stance phase on mid-stance slightly higher on left 39.9% than the right 39.7% but bigger change then before 44.1% for left and 44.6% for right. Swing phase took more on right 60.3% than left 60.1% although it was less before on right 55.4% and left 55.9%. Step length longer right 84cm than left 83cm, step with the same 10cm before 10cm too, step time became the same 0.37 sec for both right and left and before was 0.38 sec for left and 0.37 for right and cadence three step more than before 159 step/minute to 162 step/ minute.

Forces on foot shifts bigger force were on forefoot for both right 921N and left 1013.2N feet with higher left forefoot after; on mid foot left foot higher 512N than right 337, 2N and heel forces left 471.9 N was almost the same as right heel 470.9N. In addition, forefoot forces used to be higher on right 1047.8 than left forefoot 974, 6N and also heel forces used to be higher on right heel 320, 5N than left 276, 2N.

Stance parameters: (P, ACL) AFTER FIFA 11+, (H, ACL), (T, ACL). Show different stance parameters for control person (H, ACL) and non-control patient (T, ACL) with comparing to (P,ACL) after FIFA 11+; COP with open eyes came higher 511 mm for (H, ACL) while (P,ACL) came next 160 mm and (T, ACL) is last 106 mm while it was in close eyes higher 381 mm for (P,ACL) next came 259 mm (H, ACL) and finally 220.8 mm (T, ACL). Ellipse was higher with open eyes 497 mm^2 (H, ACL) next 117 mm^2 (P, ACL) finally 23.3 mm^2 (T, ACL) whereas with close eyes 287 mm^2 for (P, ACL) higher than 235 mm^2 (H, ACL) and 50.0 mm^2 (T, ACL). Average forces come equally for (H, ACL) & (P, ACL) at open eyes right 49% left 51% and also with close eyes right 50% left 50% while (T, ACL) open eyes right 52.8% left 47.2%, close eyes right 52.9% left 47.1%.

Gait parameters: (P, ACL) AFTER FIFA 11+, (H, ACL). Gait parameters 4kmph in 1 mint for control person (H, ACL) with comparing to (F, PACL) after FIFA 11+; stance phase show equal percentage load response and pre-swing for both right 12.7% left 12.7% but midstance is higher on right 38% than left 36.5% for (P,ACL) while stance phase with (H,ACL) show higher percentage load response 14.2% and midstance 36.9% on right than left load response 13.8% and midstance 35.2% but less percentage on right pre-swing 13.8% than left pre-swing 14.1%. Swing phase higher on right 36.6% and left 38.0% for (P, ACL)

than (H, ACL) right 35.2% and left 36.9%. Step length equal on left 60cm and higher on right 59cm for (P,ACL) than right 58cm (H, ACL), step time took longer for right 0.52 sec and left 0,54 sec (P,ACL) than right 0.51 sec and left 0.53 sec (H, ACL) while cadences were more 115 steps/minute for (H, ACL) and 113 steps/minute (P,ACL) also step width is longer 19cm for (P,ACL) than (H, ACL) 11cm. Forces on foot were higher on forefoot both (H, ACL) & (P, ACL). A forefoot force was higher for (H, ACL) right 819, 2N and left 816, 4N more than (P, ACL) right 786,7N and left forefoot 756,1N. On mid foot were higher on right 208, 6N and left 211, 7N (P, ACL) than (H, ACL) right 45,0N and left 101,8N and finally heel forces were higher on right 596, 8N and left 596, 8N (H, ACL) than right 391, 4N and left 434, 0N (P, ACL).

Gait parameters 8kmph in 1 mint for control person (H, ACL) with comparing to (P, ACL) after FIFA 11+; stance phase show equal percentage right 39.7% and left 39.9% midstance for (P, ACL) while stance phase with (H, ACL) show higher percentage midstance 44.8% on right 46.2% on left. Swing phase higher on right 60.3% and left 60.1% for (P, ACL) than (H, ACL) right 53.8% and left 55.2%. Step length on left 83cm and longer on right 84cm for (P, ACL) than right 80cm and left equal 83cm (H, ACL), step time took equal for right and left 0.37 sec (P, ACL) than right 0.36 sec and equal left 0.37 sec (H, ACL) while cadences were more 166 steps/mint for (H, ACL) and 162 steps/minute (P, ACL)also step width is longer 10cm for (P, ACL) than (H, ACL) 9cm. Forces on foot were higher on forefoot both (H, ACL) & (P, ACL). A forefoot force was higher for (H, ACL) right 1206, 3N and left 1149, 3N more than (P, ACL) right 921, 0N and left forefoot 1013, 2N. On midfoot were higher on right 337, 2N and left 512, 0N (P, ACL) than (H, ACL) right 117, 2N and left 289, 7N and finally heel forces were higher on right 484, 4N and left 533, 8N (H, ACL) than right 470, 9N and left 471, 9N (P, ACL).

Gait parameters: (P, ACL) AFTER FIFA 11+, (T, ACL). Gait parameters 4kmph in 1 minute for non-control person (T, ACL) with comparing to (P, ACL) after FIFA 11+; stance phase show equal percentage load response and pre-swing for both right 12.7% left 12.7% but midstance is higher on right 38% than left 36.5% for (P, ACL) while stance phase with (T, ACL) show higher percentage load response 15.1% and midstance 36.2% on right than left load response 13.2% and midstance 35.5% but less percentage on right pre-swing 13,1% than left pre-swing 15.1%. Swing phase equal on right 35.5% and higher on left 38.0% for (P, ACL), (T, ACL) right 35.5% and lesser on left 36.3%. Step length lesser on left 60cm and longer on right 59cm for (P, ACL) than right 36cm left 63cm longer (T, ACL), step time took lesser time for right 0.52 sec and left 0.54 sec (P, ACL) than right 0.55 sec and left 0.58 sec (T, ACL) while cadences were more 113 steps/ minute for (P, ACL) than 107 steps/ minute for (T, ACL)also step width is longer 19cm for (P, ACL) than (H, ACL) 13cm. Forces on foot were higher on forefoot both (T, ACL) & (P, ACL). A forefoot force was higher for (P, ACL) right 786, 7N and left 756, 1N more than (T, ACL) right 706, 0N and left forefoot 711,0N. On midfoot were higher on right 208, 6N and left 211,7N (P, ACL) than (T, ACL) right 175, 1N and left 198, 2N and finally heel forces were higher on right 391, 4N and left 434, 0N (P, ACL) than right 404,9N and left 478, 9N (T, ACL).

Gait parameters 8kmph in 1 mint for non-control person (T, ACL) with comparing to (P, ACL) after FIFA 11+; stance phase show equal percentage right 39.7% and left 39.9% midstance and 0.0 for both load response and pre-swing for (P, ACL) while stance phase with (T, ACL) show higher percentage midstance 48.2% on right 48.6% on left with right load response 0.2% and left pre-swing 0.2%. Swing phase higher

on right 60.3% and left 60.1% for (P, ACL) than (T, ACL) right 51.5% and left 51.1%. Step length on left 83cm and longer on right 84cm for (P, ACL) than right 82cm and left 80cm (T, ACL), step time took equal for right and left 0.37 sec (P, ACL) than equal right 0.36 sec and left 0.36 sec (T, ACL) while cadences were more 167 steps/minute for (T, ACL) than 162 steps/minute (P, ACL) also step width is longer 10cm for (P, ACL) than (H, ACL) 8cm. Forces on foot were higher on forefoot both (T, ACL) & (P, ACL). Forefoot forces were lesser for (T, ACL) right 828, 6N and left 862, 3N more than (P, ACL) right 921, 0N and left forefoot 1013, 2N. On midfoot were higher on right 337,2N and left 512, 0N (P, ACL) than (T, ACL) right 282, 1N and left 414, 9N and finally heel forces were higher on right 573, 4N and left 582, 9N (H, ACL) than right 470, 9N and left 471, 9N (P, ACL).

*Patient (P, ACL) feels stable on his right knee by marking on (VAS):

-Before FIFA 11+ training he marked (3 of 10).

-After FIFA 11+ training he marked (6 of 10).

5. Discussion

The purpose of the project was to review about different ACL injury prevention programs. Also chosen a challenge, easy and widely available program called “FIFA 11+” to apply it on (P, ACL) patient. Additionally, by analyzing through FDM-T system on my results I show how variables had shifted on (P, ACL) before starting FIFA 11+ and after introducing and applying it. Furthermore, my results show the variances and concurrences between different ACL injuries. Finally explain how FIFA 11+ role on (P, ACL) patient.

5.1 The different ACL injury prevention programs on soccer

Many of these regimens have proved themselves in clinical trials, in which some teams do the exercises and other teams stick to their usual warm-ups. Noyes and Barber-Westin [50] showed that Sports metrics reduced the risk for noncontact ACL injuries by 88%-100% in soccer. Barber-Westin speaks [53] "You can see in 6 weeks that you really can change these dangerous movement programs that you see in female athletes. Prevent injury and Enhance Performance (PEP) reached similar success, decreasing the risk for ACL injuries by 82% in soccer alone. The number of challenging programs can be baffling. But they have a lot in common. They train athletes to land softly on the forefoot and roll back to the heel, engaging the knee and bending their hips on landing and when making lateral cutting exercises. They explain how to avoid excessive bow knee on landing, squatting, and running. Most of the programs also include jumping exercises (plyometric), as well as hamstring, gluteus medius, core, and hip abductor strength exercises aimed at correcting misbalances [50-52,54-56].

But the success of a program hangs partly on the aftereffect measured. Some of the programs include stretching exercises; others don't also these programs work differently, and their inventors are each ready with conflicts for why theirs is the top. For example, Barber-Westin [53] resists that repeating the exercises multiple times per week will lead to lowly compliance. She says. “Soccer athletes are quad-dominant," that’s Holly Silvers [57] who run with Mandelbaum [57] went on to help improve FIFA11+, a program for soccer's governing body, the Federation International of Football Association (FIFA), which censored generally injuries for male soccer players. If athletes don't keep up the exercises, they become less efficient over time, she says. "The reality is you lose compliance," she notes. "If you abandon them,

you get recidivism. There is a benefit to continuous development over the season. To avoid boredom, the FIFA11+ program offers 3 levels of some exercises so that athletes can challenge themselves to improve which made me to choose FIFA 11+ [57].

5.2 Hypothesises testing

H^{01}patient feels more stable on his right knee after training on (Chart 1) it showed what (P, ACL) had marked before and after FIFA 11+ program therefore is accepted.

H^{02}: we see different parameters before and after FIFA 11+ for (P, ACL):

*__Stance parameters:__

- The COP path length decrease.
- Body disturbance will be equally for both right and left feet.
-Ellipses will decrease.

*__Gait parameter__ (jogging 4kmph in 1 minute):

-Stance phase decrease on left foot.
-Swing phase increase on left foot.
-Step length and width increase for right foot unless step time will remain the same.
-Cadence will decrease.
-Maximumforces on right foot parts will decrease.

*__Gait parameter__ (running 8kmph in 1 minute):

-Stance phase decease on both feet.
-Swing phase increase on both feet.
-Step length decrease, step width and time remain the same unless step time for left feet increase.
-Cadence increase.
-Maximum Forces on heel part increase.

Through stance on legs, jogging (4Kmph/1 minute)report& running (8Kmph/1 minute)they showed all the above on the results therefore is accepted.

H^{03}: I assumed after training (P, ACL) will have same similarity parameters to (H, ACL):

*__Stance parameters:__

-Body disturbance will be equally for both right and left feet.

*__Gait parameters__ (jogging 4 kmph in 1 minute):

-Stance phase.
-Swing phase
-Step length, width and time.
-Cadence
-Maximum forces on feet parts for both right and left.

*__Gait parameters__ (running 8kmph in 1 minute):

-Stance phase. -Step length, width and time. -Cadence.
-Swing phase. -Maximum Forces on feet parts for both feet.

Looking through on the results show there some similarity on:

*__Stance parameters:__

-Body disturbance will be equally for both right and left feet.
*Gait parameters (jogging 4 kmph in 1 minute):
-Step length on left foot
*Gait parameters (running 8kmph in 1 minute):
-Step length and time on left foot.
Due to the above similarity it is accepted.

5.3 Comparing with other researcher's results

A latest review of the literature indicated that the incidence of injury during soccer games tended to rise with age across all age groups; with an average incidence of 15 to 20 injuries per 1000 hours of game play in company with players older than 15 years [58]. A study of sport injuries conducted over a 10-year period detected 19,530 sports injuries in 17,397 patients. Football accounted for the highest number of injuries; 37% of all injuries reported (7.769 injuries) of which the majority were related to the knee 39.8% [59].

It is essential to identify that it is also accompanied by a considerable risk of muscle and ligament injuries [60]. Injuries to the lower extremities are the most common in soccer with an incidence rate of 60-90% [26,62] and the ACL is the most commonly injured [61,6]. Injuries range from partial, such as a minor tear, to total rupture, such as when the ligament tears totally or when the ligament and bit of the bone separate from the rest of the bone [22]. Anterior cruciate ligament injuries are believed to occur due to unsuccessful postural correction and abnormal dynamic loading, i.e., inter-segmental weights in the knee joint [23]. (P, ACL) patienthas misbalance on postural can be due to weight (3.2.1 Examination patients) one of factorsmayassociate with the risk of injury during soccer i.e., competitive level, age, gender, and weight [45] or even some other popular of the ACL injuries (about 70%) occur in a non-contact conjuncture [23].The injury mechanism for ACL injuries in female team handball is reported to be a forceful valgus collapse with the knee nearly to full extension combined with external or internal tibia rotation that was the same with (P, ACL) but with soccer game [24]. Essentially, more specific exercises need to be added to the training (warm-up) routine A mixture of exercise programmes have been developed with the aim of reducing the number of injuries resulting from soccer practice [43]. These exercise programmes may be presented as part of the athlete's training, as in other sport controls, which might reduce the validity of such a routine. These exercises need to respect the physical burdens of soccer, planning to be a method of improving static and dynamic balance neuromuscular control and proprioception, especially of the knee and hip due to the big groups of muscles around these joints. When a group of international experts from the following groups: FIFA's Medical Assessment and Research Centre (FMARC), Santa Monica Orthopaedic, Oslo Sports Trauma Research Centre and Sport Medicine Research Foundation-who had created a past experience in soccer injury prevention programmes-developed a precise program to prevent injuries in soccer: the FIFA 11+.

According to the developers of the "The 11+", it can be considered as a complete warm-up programme whose main goal is to lack the risk of common injuries that are associated with soccer [46]. Among the advantages of "The 11+" are the facts that the programme takes only about 15–20 minutes to complete and with no need for equipment other than soccer ball beside it can be accessed freely through the FIFA

website making this program widely available. It is important to highlight that these exercises are old discovered, but they have not become yet routine in training programs. The new form is that these exercises are brought together in a programme that is easy and viable, and could be a standard warm-up before training sessions. Apparently, different studies [12,43,44] have been controlled with the aim of assessing the effectiveness of the FIFA 11+ warm-up programme included my project where body disturbances came equally and (P, ACL) gained more self-assured in reducing the number of injuries sustained by soccer players.

Running depends upon the body to absorb continuous repeated impact forces or powers, and running-related injuries are a common presentation in any physiotherapy or sports medicine clinic [63].At the extreme, elite endurance runners will probably require a weekly physiotherapy treatment, entire year round, to maintain their bodies healthy looking through amateurs participants soccer players running results on running (8 Kmph, 1 Minute) report, running (8 Kmph, 1 minute) & jogging (4 kmph, 1 minute) report they also need to be told about require physiotherapy treatment [64] the complicated and highly individual interplay between intrinsic (personal) and extrinsic (environmental) factors that may contribute to injury during running process. Particularly, the biggest predictors of injury are the following two extrinsic factors [64]:

- Absolute volume of running undertaken
- Unexpected changes in volume or intensity of running.

By contrast, research is ambiguous when it comes to diagnose specific biomechanical patterns (intrinsic factors) that cause injury [63]. Therefore, it is probably safe to assume that, for a given amount of weekly running, an individual with an abnormal or unprepared running action is more likely to suffer injury than someone with good mechanics. Every runner will have their own threshold of tolerance to the stresses of running, and it will take a unique combination of influences to tip that runner's body over the threshold and in to injury [63]. The running cycle comprises a stance phase, where one foot is in contact with the ground while the other leg is swinging, replaced by a float phase where both legs are off the ground. The other leg then makes contact with the ground at the same time the first leg continues to swing, followed by a second float phase [64]. It is not surprisingly, during the stance phase that the greatest risk of injury rises, as forces are working on the body, muscles are in active to control these forces, and joints are being loaded [63].While after FIFA 11+ been applied to (P, ACL) on Running (8 Kmph, 1 minute) report show decreased stance phase and with compared to (T, ACL) on Jogging (4 kmph, 1 minute) & (Running (8 Kmph, 1 minute) reported decreased stance phase with (P, ACL) on addition rivalling with (H, ACL) it was reported on Jogging (4 Kmph, 1 m minute in) report &Running (8 Kmph, 1 minute) report that (P,ACL) decreased stance phase by FIFA 11+. The correct movement patterns of the hip, knee and ankle gathered with correct activation and strength of the major leg muscles will help take over braking forces during running and result in a more efficient action using tendon elastic energy and minimising landing forces [63,64]. On jogging (4 Kmph, 1 Minute) report it reported for (P, ACL) through jogging decreased feet maximum forces through all right foot parts (injured) after applied FIFA 11+ and while during running only forefoot decreased Running (8 Kmph, 1 Minute) report.

6. Conclusion and Suggestions

The project studied after ACL injury rupture in focus toward partial tear injury and discovered how prevention program FIFA 11+ is effective after ACL partial tear. The findings of the study shown that there was not a significant relationship in the ACL partial tear injury of the patient but he returns to his activity with self-assured toward his injury. Findings from other studies also given that good prevention training make functional satisfactory effect possible after ACL partial tear and from the results of this study. Nevertheless, we cannot say that the FIFA 11+ for partial ACL injury offers the best prevention exercises. For some limitations reasons like it would have been a different result if more patients were treated using the same prevention program although the study determined that though the patient was able to go back to soccer activity, whole body balance and functions was not fully restored to the affected (right) leg.

This suggests there could be other exercises that can be added to the program or even increase time of the training. This project recommends other studies to be carried out to test different patients to develop probability strong provability and reduce statistical systematic error that could have caused due to lack number of tested cases for my project.

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