

**POTENTIAL MECHANISM OF INJURY CAUSING ACL IMPAIRMENT.**

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**Abstract**

**Introduction:** The anterior cruciate ligament (ACL) in an intra-articular ligament, it plays important role in stability of knee joint **Objective:** find out exact mechanism of ACL injury. **Materials and Methods:** This prospective observational study was carried out at orthopaedic department of Liaquat National Hospital and Medical College, Karachi from JAN 2017 to DEC 2019. **Results:** All the patients were followed in outpatient department. Total of 180 patients were included in the study (145 were males and 35 were females). There were two major group of patients (1) those had non-contact ACL injuries, (2) who had contact ACL injuries. Cases who had (non-contact) twisting injuries were 108(60%), (contact) road traffic accidents were 28(16%), direct blow to the knee were 25(14%) and injury after high jump were 19(10%). **Conclusion:** We found that most common mechanism of injury in non-contact ACL injury is twisting injury.

**Key words:** Potential Mechanism, Injury, ACL Impairment

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**INTRODUCTION**

The anterior cruciate ligament (ACL) in an intra-articular ligament, it plays important role in stability of knee joint and it consists of two bundle of fibers anteromedial (AM) and posterolateral (PL), named after their attachment site, in between femur and tibia<sup>1</sup>. Anterior cruciate ligament (ACL) injuries are among the most commonly studied injuries in orthopaedic research and increase cause of concern. Increasing participation of athletics in sports causing increasing rates of injury such anterior cruciate ligament (ACL) injury. Injuries to the ACL can be more problematic by affecting athletics' participation in sports and financial cost related to the treatment<sup>2</sup>. In addition to that, it can also cause long term complications to the knee, such as changes in knee kinetics and eventually knee osteoarthritis<sup>3</sup>. Worldwide incidence of ACL ruptures is estimated to be ranged from 30 to 78 per 100,000 person-years<sup>4</sup>. Therefore, there has been increasing interest in understanding mechanism and prevention of injury. Many researchers have used different modalities to explain the exact mechanism of anterior cruciate ligament injury. However, despite all information gathered mechanism remain incompletely understood. Previous studies

suggested that gender and anatomical structures contributed to the ACL injury but it was impossible to change the gender and anatomical structure for the prevention of injury<sup>5</sup>. ACL injury which occurs without direct contact with the another object or person is known as non-contact ACL injury. About 70% of the injuries occurs due to non-contact events<sup>6,7</sup>. On the other hand, contact ACL injuries are those which occurred as a result of valgus collapse of the knee. Only way of preventing the risk of injury is by understanding the injury mechanisms, specifically the non-contact injury type. Therefore, In this study we aimed to find out exact mechanism of ACL injury. This will help us to enhance our understanding of mechanism and help to guide current prevent measures.

**MATERIALS & METHODS**

**Study design:** This prospective observational study was carried out at orthopaedic department of Liaquat National Hospital and Medical College, Karachi from JAN 2017 to DEC 2019. This study focusing on the patients who had anterior cruciate ligament injury between JAN 2017 to DEC 2019. **Inclusion criteria:** All patients (athletes) between 18-45 years of age, who had ACL injury and concomitant meniscal

injury along with medial collateral ligament injury with no previous bony injury were included in this study. **Exclusion criteria:** Patients under 18 years or greater than 45 years of age, with multiligamentous injuries, and involves revision ACL injuries, associated with bony, vascular and neurological injuries were not included in this study. **Sample size estimation:** There were no appropriate data to use for sample size estimation, our sample size is a result of convenient data sampling based on our sample size. Total of 180 participants with an estimation of 75% males and 25% females were recruited. On the basis of this size for our convenience sample, our study was adequately powered with (80% power level) to detect minimum of 10% standard deviation. **Participants:** During the JAN 2017 to JUNE 2019, total of 180 patients who experienced ACL injury and presented in orthopaedic department at Liaquat National Hospital and Medical College. After those patients who met the above mentioned inclusion criteria were identified as successful participants for this study. **Measures:** A general questionnaire was asked to fill by the patients who presented at the orthopaedic department after having their ACL injury. Total of 180 patients were followed under study, 145 men and 35 women, a response rate of 75%. All the patients had their ACL injury. All the subjects were diagnosed as having an ACL injury confirmed by magnetic resonance imaging and/or an arthroscopic procedure. **Procedure:** The general questionnaire used in

this study, which included the questions about grading the pain levels from 0 to 10, gender, pre-injury activity level, mechanism of injury and activity at the time of the injury. We broadly categorized the mechanism of injury into two variables: 1. Contact injury 2. Non-contact injury, those further classified as 1. Direct blow to knee. 2. Road traffic accident 3. Twisting injury 4. Injury after high jump. **Data analysis:** We compared different mechanisms of injuries and analyzed the data. According to that we divided the groups into two variables: 1. Contact injury 2. Non-contact injury, those further classified as 1. Direct blow to knee. 2. Road traffic accident 3. Twisting injury 4. Injury after high jump.

## RESULTS:

All the patients were followed in outpatient department. Total of 180 patients were included in the study (145 were males and 35 were females). Mean age of patients at the time of study was 25 years (ranges from 18 years to 45 years). We were able to summarize the data of these mechanisms. There were two major groups of patients (1) those had non-contact ACL injuries, (2) who had contact ACL injuries. Cases who had (non-contact) twisting injuries were 108(60%), (contact) road traffic accidents were 28(16%), direct blow to the knee were 25(14%) and injury after high jump were 19(10%). as summarized in table 1.

|   | <b>n = 180</b>        |
|---|-----------------------|
| Characteristics                             | N(%) or mean $\pm$ SD |
| Male  | 145 (82.2%)           |
| Female                                      | 35 (19.4%)            |
| Age   | 25 (18-45 years)      |
| <b>Mechanisms Of Injury</b>                 |                       |
| Twisting injury (non-contact injury)        | 108(60%)              |
| Injury after high jump (Non-contact injury) | 19(10%)               |
| Road traffic accidents (contact injury)     | 28(16 %)              |
| Direct blow to knee (contact injury)        | 25(14%)               |

## DISCUSSION

Anterior cruciate ligament plays an important role in stability of knee and has been an integral part of structural integrity of knee which consists of complex ligamentous anatomical structure of knee. It plays a vital role in providing stability to the knee during sports and various daily life activities, however injury to anterior cruciate ligament results in instability of the knee. The complete anterior cruciate ligament is most common injury results from unstable knee, therefore it is mandatory to understand the mechanism of injury. It is highly recommended to restore the knee stability for achieving better

prognosis. According to the Caborn et al<sup>8</sup> If ACL injuries remain un-addressed, it may lead to meniscal injuries. The main mechanisms of the non-contact ACL injuries were still unknown but studies showed the involvement of multiple vectors of force on the knee, or multi-planar loading<sup>9</sup>. Many Observational studies demonstrated that combination of valgus and twisting moments are the main culprits. In addition to that, many rotational forces cause more tension on ACL which leads to its injury<sup>10, 11</sup>. To find mechanism of the ACL injury so difficult, because of multiplanar motion of the knee. In our study, we found that twisting injury cases were the most common in both the male and the female subjects in non-contact ACL injury cases.

**CONCLUSION**

It is hard to draw any conclusion from this study as this is only conducted in one centre. However we found that most common mechanism of injury in non-contact ACL injury is twisting injury. In addition to that, further studies are required to validate this data.

**ETHICS APPROVAL:** The ERC gave ethical review approval

**CONSENT TO PARTICIPATE:** written and verbal consent was taken from subjects and next of kin

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**REFERENCES**

1. Girgis FG, Marshall JL, Monajem A: The cruciate ligaments of the knee joint. Anatomical, functional and experimental analysis. *ClinOrthopRelat Res.* 1975, 216:231. 10.1097/00003086-197501000-00033
2. Myer GD, Ford KR, Hewett TE: Rationale and Clinical Techniques for Anterior Cruciate Ligament Injury Prevention Among Female Athletes. *J Athl Train.* 4:352-364.
3. Lohmander LS, Ostenberg A, Englund M, Roos H: High prevalence of knee osteoarthritis, pain, and functional limitations in female soccer players twelve years after anterior cruciate ligament injury. *Arthritis Rheum.* 2004, 50:3145-3152. 10.1002/art.20589
4. Gans I, Retzky JS, Jones LC, Tanaka MJ: Epidemiology of Recurrent Anterior Cruciate Ligament Injuries in National Collegiate Athletic Association Sports: The Injury Surveillance Program, 2004-2014. *Orthop J Sports Med.* 2018:2325967118777823-2018. 10.1177/2325967118777823
5. Kobayashi H, Kanamura T, Koshida S, et al.: Mechanisms of the anterior cruciate ligament injury in sports activities: a twenty-year clinical research of 1,700 athletes. *J Sports Sci Med.* 2010:669-675.
6. Boden BP, Dean GS, Feagin JA Jr, Garrett WE Jr: Mechanisms of anterior cruciate ligament injury. *Orthopedics.* 2000 23,
7. Griffin LY, Agel J, Albohm MJ, et al.: Noncontact anterior cruciate ligament injuries: risk factors and prevention strategies. *J Am AcadOrthop Surg.* 2000, 8:141-150. 10.5435/00124635-200005000-00001
8. Caborn DN, Johnson BM: The natural history of the anterior cruciate ligament-deficient knee. A review. *Clin Sports Med.* 1993, 12:
9. Shimokochi Y, Shultz SJ: Mechanisms of noncontact anterior cruciate ligament injury. *J Athl Train.* 2008, 43:396-408. 10.4085/1062-6050-43.4.396
10. Markolf KL, Gorek JF, Kabo JM, Shapiro MS: Direct measurement of resultant forces in the anterior cruciate ligament. An in vitro study performed with a new experimental technique. *J Bone Joint Surg Am.* 1990, 72:
11. Markolf KL, O'Neill G, Jackson SR, et al.: Effects of applied quadriceps and hamstrings muscle loads on forces in the anterior and posterior cruciate ligaments. *Am J Sports Med.* 5:1144-1149.