

RESEARCH PROPOSAL

**“ANTERIOR CRUCIATE LIGAMENT: ANATOMY,
SYMPTOMS AND RECONSTRUCTION”**

NUMBER OF WORDS: **1857**

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Anterior cruciate ligament: anatomy, symptoms and reconstruction

Background

General introduction. Located in the centre of the knee, the anterior cruciate ligament (ACL) is a strong band of tissue that prevents the shin bone (tibia) from extending excessively beyond the thigh bone (femur). The ACL provides almost 90% of the stability to the knee joint and experiences dramatic surcharges during people's physical activity. As a result, ACL injuries appear common and usually sports-related traumas. Almost any sport that involves jumping, cutting or twisting has an inherent risk of an ACL rupture. However, in modern medicine these kinds of injuries are especially associated with such events as basketball, football, volleyball, tennis and skiing where the loading on ACL increases in dozens times. Due to the achievements of modern surgery today's athletes have greater than a 90% chance of returning to their pre-injury level of sports participation.

Anatomy. There are four primary stabilizers of the knee, i.e.: ACL, the PCL (Posterior Cruciate Ligament), the MCL (Medial Collateral Ligament) and the LCL (Lateral Collateral Ligament). These ligaments function in concert with the muscles and cartilage of the knee to help control motion. Proprioceptive (nerve) fibers in these ligaments and the capsule of the knee joint augment this control via reflex feedback. The anterior cruciate ligament and the medial collateral ligament are most often injured in sports.

A knee without an ACL may show signs of instability, with unsettling episodes of unpredictable knee motion during cutting (running with sudden changes of direction), jumping, or running up or down hills. Such episodes put the menisci ("C"-shaped cartilage rings that serve as bumpers between the thigh and leg bones) at risk for injury. Children and adolescents with anterior cruciate deficient knees will typically end up competing at a lower activity level than pre-injury. Also, despite the use of specially designed braces, additional knee injuries during play can occur.

ACL injures occurrence. According to medical statistic, ACL ruptures occur at a rate of 60 per 100.000 people per year in the United States. With society's growing interest in physical activities the scientists expect dramatic growth of ACL related traumas in an early date. As a result, there is a strong necessity to provide an all-round understanding of the ACL injury itself (its anatomy, major reasons of traumas and their prevention, etc.) as well as evaluate the methods that are beneficial in treatment of ACL injuries.

Injuries to the ACL can occur in a number of situations, including sports, and can be quite serious, requiring surgery. An ACL injury may result from a violent, twisting motion (deceleration, valgus, rotation) of the knee, which can occur when an athlete plants his or her foot and suddenly changes direction. The ACL can also tear if the knee is 'hyperextended' (bent backwards).

There are several major identified reasons of ACL injures. They are as following

- Sudden stops and twisting motions of the knee, or a force or "blow" to the front of the knee.
- The extent of the tear.
- Simultaneous injures of the other structures inside the knee joint.

Symptoms of ACL injure. If injured, the ACL usually has the following symptoms:

- Pain at the time of impact which dies away afterwards.
- Swelling.
- If the swelling comes on rapidly then it could be caused by bleeding within the joint.
- In the later stages when the swelling has decreased there might be instability in the joint.
- Pain when you bend the leg and have the tibia (lower leg bone) pulled forwards.

Classification of ligament injures. ACL injures are usually graded in terms of their severity:

- *Grade I sprain* – some micro-tearing or slight stretching occurs, however the overall integrity of the ligament is preserved. The ligament hurts if stressed but is stable.
- *Grade II sprain* – partial disruption of the ligament. Painful to stress, there is detectable laxity but the ligament has an eventual endpoint.
- *Grade III tear* – complete ligament tear and laxity with no endpoint or stability to testing. As the nerves in the ligament are torn too, there is often minimal pain with stressing the joint.

Repair and reconstruction of ACL. ACL *repair* can be accomplished in selected tears where the ligament tissue is in good condition, the tear is close to the bone, and best if the patient is over 35 years old.

Surgical *reconstruction* of the ACL is indicated for patients with unstable knees who desire to remain active. We reconstruct the ligament with a graft from the patient's own knee or from a donor cadaver knee using a bone-patellar tendon-bone graft. When followed with an intensive rehabilitation program that we custom design for each patient the results are that 90% of patients can return to full sports with a stable knee. ACL reconstruction is a complex process and although the success rate is generally 85-95%, there are times when the reconstruction is unsuccessful.

Rehabilitation. The post-surgery recuperative period and rehabilitation program can be even more important than the surgery itself. Activities should be arranged to promote healing, upgrade flexibility in the knee, and strengthen surrounding muscles. A passive range of motion program (stretching) following surgery aids in the healing process, promotes better nutrient flow to the cartilage caps at the ends of the femur and tibia, and prevents excess tightness from developing in the knee. A hinged knee brace which prevents hyperextension or hyperflexion should be used during the four to six weeks after surgery in order to prevent ruptures of the new ACL (stretching activities take place without the brace on, however).

Research Aims

Generally, amidst all the anatomy, symptoms and reconstruction of the ACL this project will examine major reasons of ACL rupture amidst different groups of patient

with the primary focus on sportsmen. The present project is also targeted to evaluate major modern methods of ACL treatment and assess their effectiveness for different kinds of ACL traumas. The project will also explore a number of medical and, particularly, surgical problems related to the ACL.

The major objectives of this study are:

1. Identify the anatomy of ACL and assess the threats for its trauma amidst different layers of people.
2. Identify the key reasons of ACL rupture and evaluate their severity.
3. Recognize major symptoms of ACL and evaluate their prevalence.
4. Develop a list of most successful modern surgical and therapeutic methods of ACL treatment and evaluate their effectiveness.
5. Finally, recommend the methods how to treat ACL in different people (1), different levels of trauma's severity (2) and other related factors (3).

Literature Review

There's a list of modern as well as relatively old sources dedicated to the problem of ACL. These sources will be analyzed according to the following principle:

1. Monographs and research papers
2. Articles in medical journals
3. Internet articles and web-references

The papers will be also analyzed according to their contribution to the research field, comprehensiveness of the utilized approach, qualitative or quantitative researches, strengths and blond spots.

Research Design and Methodology

Having identified a research topic and done the preliminary literature review the next logical step is to chalk out the route map for the research project. Looking at the research process 'onion' (Saunders et. al., 2003) one can identify various approaches, strategies and data collection methods across the continuum of research philosophy.

These types of secondary information can be available in books, journal articles, newspapers & magazines, conference papers, reports, archives, films, television, electronic database, internet, etc.

The literature reviews would typically constitute the majority requirement of secondary data. Information regarding ACL anatomy, most probable reasons of traumas, ways of diagnosing and treatment as well as other vital information (required for furthering & supporting the analysis of findings from primary data) are the typical kinds of secondary data that would be used in the study. Such data are nowadays mostly available through the Internet. Alternatively, libraries are good sources of books on leading theories and thinking of experts on the subject. In the present research we will generally lean on secondary data.

Analysis of Data and Interpretation of Findings

The data obtained through the various methods discussed above would be either **quantitative** or **qualitative**. Since the research is mostly *interpretivist* in nature, there is unlikely to be too many data that might require elaborate statistical analysis of quantitative data.

Quantitative analysis is more likely to be secondary and exploratory (or descriptive) in nature, summarising data in the form of charts, tables, percentages and averages. In the event that a survey is carried out, the data obtained would mostly be categorical, hence is likely to be ranked across a scale. This data might be represented in terms of frequency, central tendency or dispersion. It is highly unlikely the research might require the necessity of inferential data analysis.

Qualitative analysis of data is expected to be more frequently used within the research than its quantitative counterpart. Although there might be scope for a certain degree of quantifying some of the data, an overall non-quantifying method is likely to be used through the data analysis and interpretation process. This would involve *categorisation, 'unitising' data, recognising relationships and developing categories to facilitate it, and developing and testing hypotheses to reach conclusion.*

Conclusion

The final report project will have the following format:

1. Title
2. Research Question
3. Literature Review
4. Research Methodology
5. Conceptual Framework
6. Primary Research
7. Analysis
8. Findings
9. Conclusions & Recommendations
10. References
11. Appendices

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