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Morphogenesis of Anterior Cruciate Ligaments on Both the Knee Joints in Adult Indian Population and Its Surgical Approaches

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KEYWORDS

Grafting, Ligament Restoration, Surgery

ABSTRACT:

Background: The femur and tibia are firmly attached to the band-like Anterior Cruciate Ligament (ACL) and Posterior Cruciate Ligament (PCL) by collagen fibres. Because they are contained within their own synovial sheath, they are regarded as extra-capsular. The ACL stabilises the knee joint and serves as a passive constraint for the tibia with respect to the femur. PCL serves as the main barrier against posterior tibial translation and is regarded as an active and primary stabiliser of the knee joint. Because of their attachment, which will be helpful in surgical approaches, anatomical knowledge is required. This article reviews the knowledge of ligament restoration and reconstruction.

Aim : The objective is to investigate the relationship between the overall length of the right knee joint's anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL).

Materials and Procedures: The cross-sectional study was carried out on MDBASMC, Deoria. Twenty patients were used in the investigation, and a digital caliper was used to assess the lengths of the ACL and PCL. The outcome of the right knee's ACL and PCL measured 29.51 ± 38.9. Using SPSS, the p-value was determined to be p=0.0011. The parametric distributions of both ligaments showed a positive association, as indicated by the Pearson's correlation (r) value of 0.2098.

Conclusion : The restoration and grafting of ligaments in any kind of avulsion require accurate understanding, which will help orthopaedic surgeons guide their patients towards correct ligament restoration.

Introduction

The Anterior Cruciate Ligament (ACL) and Posterior Cruciate Ligament (PCL) are the two primary cruciate ligaments found inside the knee [1, 2]. The development of the ACL is preceded by the PCL [3]. The PCL is the main constraint on posterior tibial translation and serves as the knee joint's active and major stabiliser. This falls under the extra-capsular ligament category since it encloses its own synovial sheath [4]. ACL and PCL measures were reported to be approximately 32–38 mm length and 11 mm wide [2, 5]. According to their tibial attachments, the ACL is composed of two bundles, primarily the Antero-Medial (AM) bundle and the Postero-Lateral (PL) bundle [6,7,8]. Likewise, PCL contains both kinds of bundles [9].

The middle genicular artery provides sustenance, and the tibial nerve innervates the bundles, which are twice as thick as the ACL [2]. The ACL stabilises the knee joint [10,11],

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prevents the knee joint from hyperextending [12], and serves as a passive restriction for the tibia with respect to the femur. As a result, ACL injuries are more common [13] than injuries to the other knee ligaments[14,15,16]. In order to identify the appropriate size for the allografting procedure during surgical reconstruction, the orthopaedic surgeon doing the cruciate ligament surgery should be knowledgeable about the numerous cruciate ligament factors [9].

Material and Methods

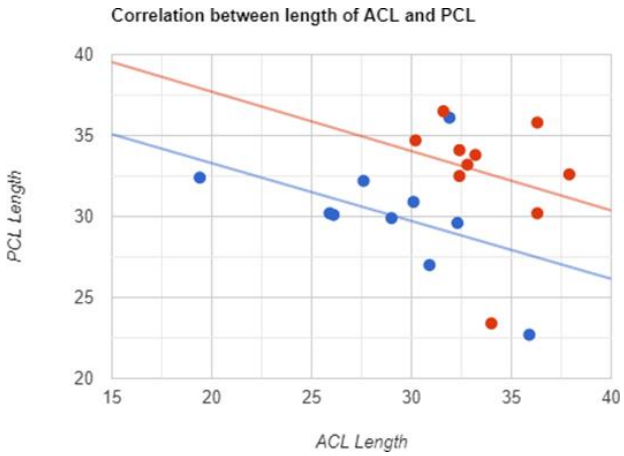
The cross-sectional observational type of study which was carried out on 20 patients from MDBASMC, Deoria and also compared with some cadaveric studies. Data is gathered using a basic random sampling technique. Any trauma or injury to the knee joint was not included. A digital caliper (Oleander OL 68595, India) was used to take all of the measurements. The place of attachment of the ACL and PCL was used to measure their length.

Table 1: Showing the parameters of Length of ACL and PCL of right knee joint

No. Patients	Parameters	Min-Max	Mean±SD	p-value	Peraso n's correla tion (r-value
20	Total Length ACL Rt. knee	19.5 35.9	29.72 ± 4.12	**0.0011**	**0.2099**
	Total Length PCL Rt. knee	23.8 38.9	33.20 ± 3.1		

*Independent T-test ($p<0.05$)

Fig 2: Showing the correlation between length of ACL and PCL of right knee joint



Statistical Analysis

MS-Excel and trial version of Statistical Package for Social Sciences (Ver. 21.0, SPSS Inc.) used for statistical analysis.

Result

The parametric distribution of the right knee's total ACL length shows mean ± SD of 29.72 ± 4.12 and 33.20 ± 3.1, falling between min-max values of 19.5 and 35.9. In contrast, the distribution of the right knee's PCL length shows mean ± SD of 23.8 - 38.9 and 23.8 – 38.9, respectively. The p-value, which was p=0.001, was determined to be significant at the 5% significance level. Upon analysing the Pearson's correlation coefficient (r), which was r = 0.29099, it was discovered that there was a positive correlation but that the association was weak **(Table 1 & Fig 2)**.

Discussion

This study gives a valuable data which represent the correlation between the length and width of the ligament for finding out the interrelationship between their different

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widths.

Table 2 : Comparison of parameters of total length of ACL and PCL of Right Knee with previous studies

S.No.	Authors (Years)	Parameters	
		Total Length ACL (Mean ± SD)in mm	Total Length PCL (Mean ± SD)in mm
1.	Yelicherla AK et al (2014)[17]	43.6 ± 4.2	36.98 ± 3.98
2.	Minh DV et Al (2019)[18]	-	35.55 ± 2.77
3.	Geetha Rani BG et. al (2019)[19]	37.15 ± 3.95	35.40 ± 3.77
4.	A.D. Sampath et (2019)[20]	28.77 ± 1.58	-
5.	Sakkarai Jayagandhi et al (2018)[21]	32.75 ± 2.26	-
6.	Rajarshi Det. al (2017)[22]	20.06 ±1.43	20.09 ± 1.139
7.	Abhinav Kumar et. al (2022)[23]	29.51 ± 3.99	33.19 ± 3.09
8.	**Present study**	29.56 ± 3.99	33.20 ± 3.08

The average total length of the ACL in the right knee joint in this investigation was 29.56 mm, which is comparable to the 28.77 mm found in the study by AD Sampath et al. [20]. In the Pondicherry region, Sakkarai Jayagandhi's study [21] measured 32.25 mm, which was slightly higher than the current study but comparable to B.G. Rani Geetha et al.'s study [19] of 37.15 mm, while Rajarshi Dutta's study [22] measured 20.06 mm, which was frequently lower than all of the aforementioned studies. The parameters were 43.6 mm, which is higher than all previous investigations conducted by Yelicharla AK et al. [17]. According to the current study, the average PCL length of the right knee joint was 33.20 mm, which was nearly identical to the findings of studies conducted by Geetha Rani BG et al. [19] in the Karnataka region and Minh DV et al. [18] in the Vietnamese community. Yelicharla AK et al.'s study found that the parameters were marginally higher in the Maharashtra region, measuring 36.98 mm. Both ligaments are considered in this study. They fall between 19.4 and 36.98 for the ACL and 23.4 and 37.15 for the right knee joint. We also tried to measure the exact connection site where the ligament starts. The entire length of both ligaments is considered in this study.

Conclusion

To help orthopaedic surgeons restore the ligament correctly in the event of any kind of avulsion, exact knowledge is required for the grafting and repair of the ACL and PCL.

Conflicts of Interests : **None**

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