

TO EVALUATE THE ASSOCIATION OF INTERCONDYLAR NOTCH WIDTH INDEX ON ANTERIOR CRUCIATE LIGAMENT TEARS

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Background: Anterior cruciate ligament (ACL) tears are a common knee injury among athletes and physically active individuals. There is evidence that the width of the intercondylar notch in the knee joint may play a role in the risk of ACL tears. The objective of this study was to evaluate the relationship between the intercondylar notch width index and the occurrence of unilateral and bilateral anterior cruciate ligament (ACL) injuries, by using magnetic resonance imaging (MRI) of the knee.

Methods: A total of 54 patients who had undergone MRI knee from January 2022 to June 2022 at Yenepoya Medical College Hospital, Mangalore, and who had suffered from ACL injuries were included in this retrospective cross-sectional study. The intercondylar notch width index was calculated from MRI images, and statistical analysis was done using SPSS 22 version software. Chi-square and student's t-test were used as tests of significance.

Results: The majority of patients had suffered injuries to the left knee. The mean intercondylar notch width index was found to be 0.254. Out of the 54 patients, 42 (77.8%) had a notch width index of <0.27 , while the rest 12 (22.2%) had a notch width index of >0.27 . Of the 54 patients, 16 (29.6%) had interstitial tear, 28 (51.9%) had a partial tear and 10 (18.5%) had a complete tear. The statistical analysis revealed a significant association between a narrow intercondylar notch width index (≤ 0.27) and the occurrence of ACL tears ($p < 0.05$).

Conclusion: The results of this study suggest that a narrow intercondylar notch width index is significantly associated with the occurrence of ACL tears. Further studies are needed to confirm these findings and to determine the clinical implications of this association.

1. INTRODUCTION

Anterior cruciate ligament (ACL) injury is the most common ligament injury of the knee and commonly occurs during sports activities. The most common injury pattern is the exertion of varus and internal rotation force on the tibia during knee hyperextension [1].

A detailed history, thorough physical examination (Lachman, anterior drawer and pivot shift tests) and imaging modalities (Magnetic Resonance Imaging) are important steps in diagnosis of ACL injuries [2].

Taking problems such as the treatment cost after ACL injuries, chronic complications like recurrent instability and osteoarthritis, and prolonged periods of return to work following the injury, particularly in athletes, into account, it is important to define the possible predictive factors in preventing ACL injuries. Several radiographic parameters such as the posterior tibial slope angle, patellar tendon-tibia shaft angle, ACL elevation angle and intercondylar notch width have been described in the literature in an attempt to define radiological risk

factors associated with ACL injury [3]. Controversy still exists on the role of intercondylar notch width as some studies advocate a possible relationship between a narrow intercondylar notch width and the risk of ACL injury while the rest suggest that there is no relationship between these two [4,5]. The purpose of this study was to evaluate the relationship of the intercondylar notch width with unilateral and bilateral ACL injury by using MR images. We hypothesized that there would be a significant relationship between a narrow intercondylar notch width and ACL injury in our patient group. In trying to identify an intrinsic anatomic difference that may lead to an increased incidence of ACL tears, the intercondylar notch width of the femur seems a likely possibility.

2. METHODOLOGY

Approval of the Institutional ethics committee will be taken before conducting the study. The study will be conducted in accordance with the ethical norms as laid down in the Declaration of Helsinki.

STUDY DESIGN

Retrospective cross-sectional study.

DETAILS OF THE METHODOLOGY

All the data will be saved in a private laptop which is password protected. Only researchers and guides will have access to the data. All patients who have undergone MRI Knee in Yenepoya medical college hospital from January 2022 to June 2022 will be identified using Hospital information system. MRI knees will be obtained with help of PACS software and will be evaluated. History of trauma will be obtained from the case file obtained from MRD. Imaging parameters included in the study are: Magnetic Resonance Imaging: The standard sequences are coronal T2-weighted fast spin-echo with fat saturation, sagittal proton-density spin-echo, sagittal T2-weighted fast spin echo, and axial proton-density fast spin-echo with fat saturation

SOURCE OF DATA/SAMPLING METHOD

Statistical Methods

Data will be entered into Microsoft excel data sheet and will be analyzed using SPSS 22 version software. Categorical data will be represented in the form of Frequencies and proportions. Chi-square will be used as test of significance. Continuous data will be represented as mean and standard deviation. Students t test will be the test of significance for Quantitative data p value <0.05 will be considered as statistically significant.

Sample Size

Patients attending Yenepoya Medical College Hospital, Mangalore who met the inclusion and exclusion criteria.

- A) Sampling technique: Complete enumeration
- B) Sample size calculation: Complete enumeration

INCLUSION CRITERIA

Patients who have had anterior cruciate ligament injuries and had undergone MRI knee at Yenepoya medical college will be included in the study.

3. RESULTS

Total of 54 patients, who met the inclusion criteria, were included in the study. Out of which, the majority have suffered injuries to the left knee. The mean notch width index was found to be 0.254. Analysis of NWI with ACL tears showed that, 42 (77.8%) of patients had a notch width index of <0.27 , while the rest 12 (22.2%) had a notch width index of >0.27 . Out of the 54 patients, 16 (29.6%) had interstitial tear, 28 (51.9%) had a partial tear and 10 (18.5%) had a complete tear.

Table 1:

Knee	Frequency	Percentage
Left	30	55.6
Right	24	44.4
Total	54	100.0

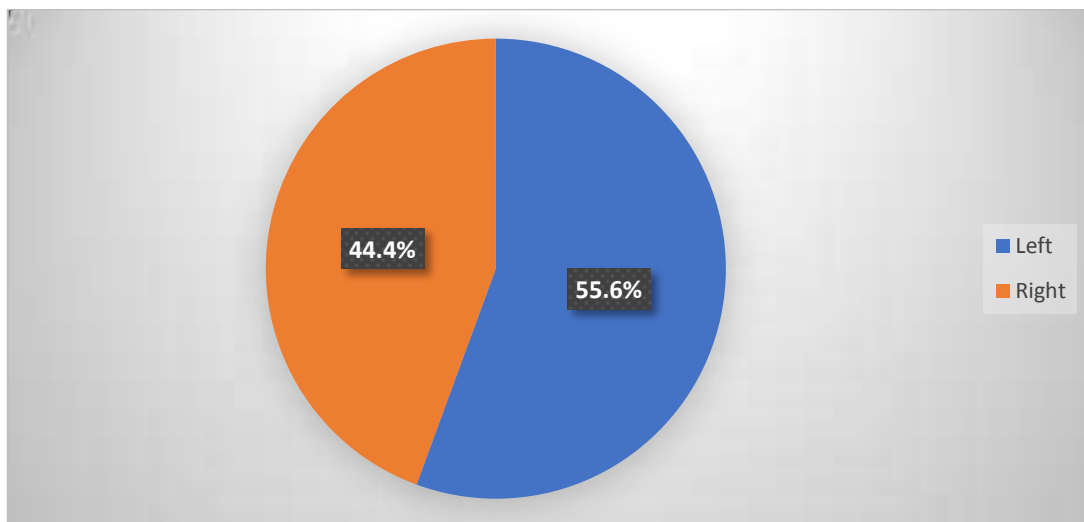


Table 2:

Grade of tear	Frequency	Percentage
Complete tear	10	18.5
Interstitial tear	16	29.6
Partial tear	28	51.9
Total	54	100.0

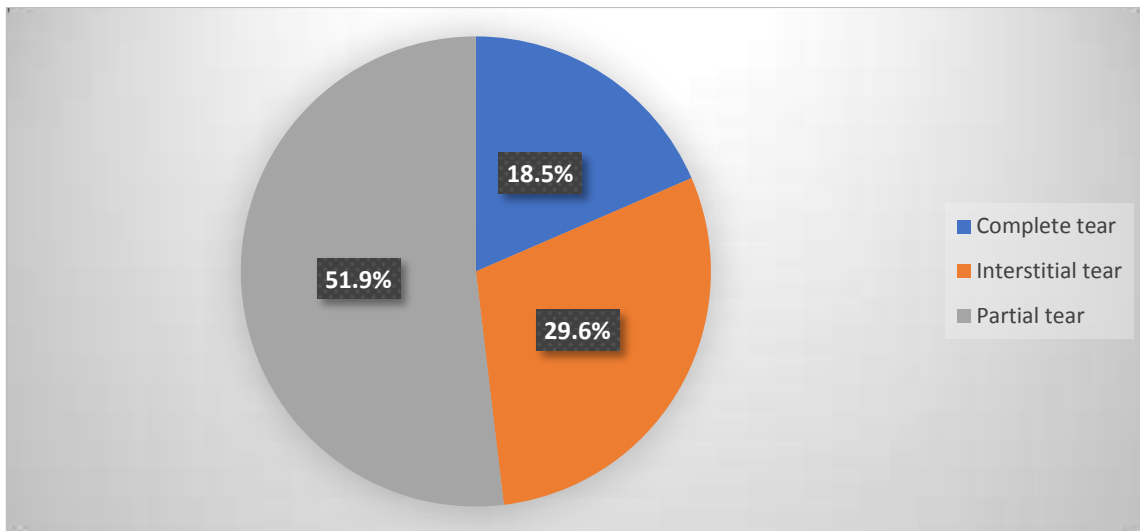


Table 3:

NWI cut off value	Frequency	Percentage
≤ 0.27	42	77.8
>0.27	12	22.2
Total	54	100.0

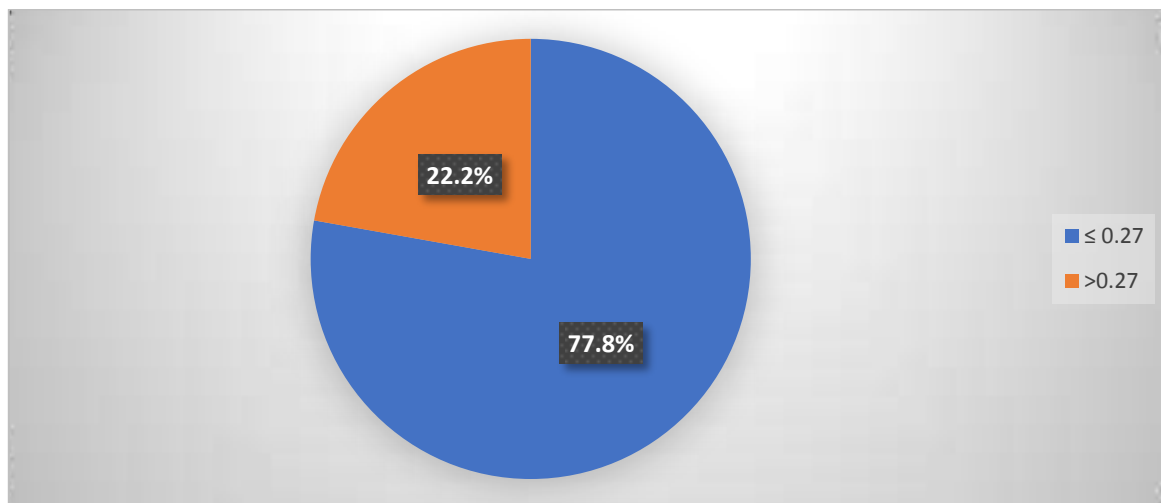


Table 4: Association between grade of tear and NWI cut off value

Grade of tear	NWI cut off value		Test statistics	P value
	≤ 0.27	>0.27		
Complete tear	8(80.0)	2(20.0)	0.301	0.910
Interstitial tear	13(81.2)	3(18.8)		
Partial tear	21(75.0)	7(25.0)		

*p value <0.05 is statistically significant

Test used : Chi square test

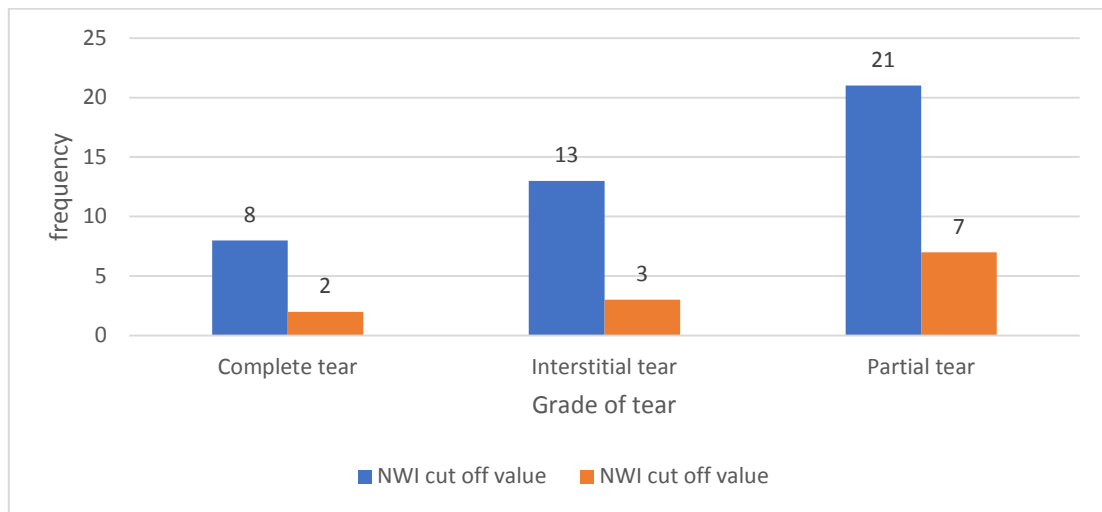


Table 5: Association between knee and NWI cut off value

Knee	NWI cut off value		Test statistics	P value
	≤ 0.27	>0.27		
Left	19(63.3)	11(36.7)	8.148	0.002*
Right	23(95.8)	1(4.2)		

*p value <0.05 is statistically significant

Test used : Fishers exact test

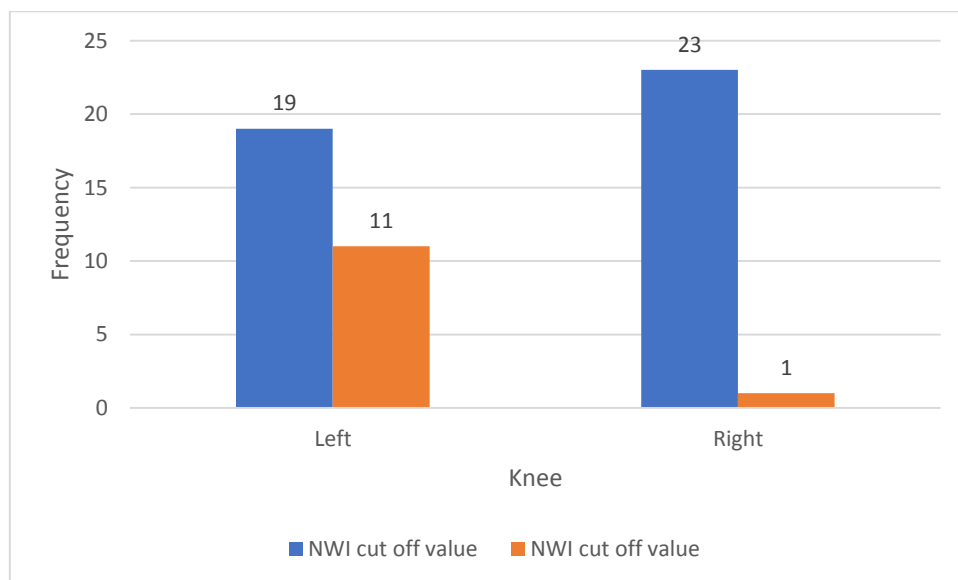


Table 6

NWI	Values
Mean± SD	0.245 ± 0.032

Median (Q1, Q3)	0.252 (0.239,0.273)
Minimum	0.177
Maximum	0.387

4. DISCUSSION

The incidence of ACL injuries is increasing because of increased participation of young adults in sporting activities. The majority of ACL injury occurs in young population and ACL is a ligament injury if necessity, Thus, ACL injury is associated with major morbidity and financial burden to most active group of population. The above mentioned factors have led to increased interest in search of risk factors for ACL injury. Many extrinsic and intrinsic have been described as risk factors for ACL injury. The factors such as lower extremity malalignment, posterior tibial slope, intrinsic ACL material properties, patellar tendon tibia shaft angle, ACL elevation angle, hormonal variation, neuromuscular control related bio mechanical factors and intercondylar notch size could be the probable intrinsic risk factors for ACL injury in literature.

One of the most important intrinsic factors, that is significantly interesting is the association of notch dimensions with ACL injuries. The association of narrow intercondylar notch with ACL injury was first recognised by Palmer. Various parameters have been identified, out of which notch shape and notch width index are most important The mean NWI of our population was found to be 0.254[6,7].

There have been conflicting reports on association between NWI and ACL injuries. Numerous attempts have been made to establish the cut off value of NWI that qualifies for narrow notch [8].

However NWI index measurements have been obtained differently in various studies. Some studies have based it on measurements on plane d-ray (notch view); some CT scans, while some based-on MRI. Both coronal and axial MRI sequences have been used in studies.

5. CONCLUSION

Mean NWI of our study population is 0.254. Narrow notch width index is present in 77.8% of ACL torn knees. Narrow notch width index is a risk factor for ACL tear.

6. REFERENCES

1. McAllister DR, Parker RD, Cooper AE. Reconstructive options for the anterior cruciate ligament-deficient knee. *Am J Sports Med.* 1996;24(6):798-808.
2. Ahn JH, Lee SH, Yoo JC, Chang MJ, Park SJ, Pae YR. Results of arthroscopic all-inside suture technique for acute anterior cruciate ligament tear: a minimum 2-year follow-up study. *Arthroscopy.* 2005;21(12):1389-1396.
3. Saper MG, Shneider DA, Kohen RB, Yut L, Greenspoon JA, Reiter MP. Intercondylar notch width and ACL tears in athletes: a systematic review. *Orthopedics.* 2017;40(2):e203-e208.
4. Slone HS, Romine SE, Premkumar A, Xerogeanes JW. The role of the lateral intercondylar ridge in preventing anterior cruciate ligament injury. *Am J Sports Med.* 2012;40(11):2586-2590.
5. Hashemi J, Chandrashekar N, Gill B, et al. The geometry of the tibial plateau and its influence on the biomechanics of the tibiofemoral joint. *J Bone Joint Surg Am.* 2008;90(12):2724-2734.

6. Agarwalla A, Gowd AK, Liu JN, et al. Intercondylar notch dimensions and properties in ACL-deficient knees and matched controls. *Knee Surg Sports Traumatol Arthrosc.* 2020;28(3):912-920.
7. Kocabey Y, Tetik O, Isbell WM, Atay OA, Johnson DL. The value of magnetic resonance imaging in the diagnosis of tears of the anterior cruciate ligament. *Arthroscopy.* 2004;20(6):578-583.
8. Inoue M, McGurk-Burleson E, Matsuda S, et al. Relationships among three-dimensional shapes of the distal femur, anterior cruciate ligament (ACL) injury history, and ACL strains in vivo. *Clin Biomech (Bristol, Avon).* 2016;38:29-35.