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Comparative study between thickness of menisci of both the knee joints & its clinical application: A Cadaveric study

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[ABSTRACT]

Background : The most important joint is the knee joint which is a type of synovial variety of hinge joint has three articulations viz. Femoral, Tibial and Patellar. The two cruciate ligaments are also present in it with medial and lateral collateral ligaments. There are two cresentic intracapsular strcutures are also present which are called as medial and lateral meniscus. Both the menisci work together to maintain stability while their morphometry are differ each other. On the process of bone remodeling and cartilage deterioration the therapeutic strategic needed for it.

Objectives : To study the comparison between thickness of menisci of both the knee joints.

Materials and Methods : The study was conducted on 20 knee joints of ten formalin fixed cadavers of unknown sex and measured the thickness of both the menisci with the help of digital caliper.

Result : The measurements of thickness of medial meniscus on right knee at its three points in which the Mean ± SD are 2.36 ± 0.39 mm, 4.27 ± 0.94 mm and 4.35 ± 0.73 mm respectively and lies in the range between 1.3-2.9, 1.8-5.8 and 2.8-5.3 whereas in lateral meniscus are 2.15 ± 0.50 mm, 4.98 ± 0.70 mm and 5.56 ± 0.69 mm and they falls between 1.4-3.2, 3.2-5.9 and 4.1-6.9. The thickness of anterior 1/3rd of both the menisci of right knee are statistically not significant but the middle 1/3rd and posterior 1/3rd (**p<0.0001**) is statistically significant. The parameters of thickness of medial meniscus on left knee at its three points are 3.2 ± 1.05 mm, 5.18 ± 1.13 mm and 5.2 ± 0.93 mm respectively and lies in the range between 2.1-

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5.6, 3.7-8.4 and 3.4-7.5. The thickness of all the points of menisci of left kneeis statistically not significant.

Conclusion : This study provides the valuable information at the time of total knee replacement and also provides the guidance to the orthopedicians.

Keywords: Osteoarthritis,Meniscal tear, Bone remodeling, Muscular contraction

INTRODUCTION

The largest and most intricate modified hinge synovial joint is the knee joint. The knee joint has three points of articulation: two between the tibial and femoral condyles, and one with the patella. The fibula lacks an articulating surface that would aid in the creation of the knee joint. [1]. Two cruciate ligaments, two menisci, and synovium lining the fat pad make up the major intra-articular structures in the knee. Any damage must be evaluated for its impact on the correct operation of these structures since they play a role in maintaining the knee's coherence. The term "internal derangement of the knee" is typically used to describe the damage to these intraarticular tissues [2]. A meniscus is formed by the mesenchymal tissue within the limb bud differentiating, and by the eighth week of foetal development, it has taken on a definite shape [3,4]. A meniscus is a crescenticintracapsular structure that only partially separates the joint cavity. When the knee is under tension or being torn, the medial and lateral menisci work together to maintain organisational stability. However, the two menisci's morphometry and insertion differ noticeably, and this has a significant clinical impact on meniscal damage [5]. The menisci are regarded as essential components for flawless articulation between the articular osseous surfaces [6,7,8] carrying out mechanical tasks like bearing the body's weight, absorbing shock, stabilizing, and facilitating rotation [9]. Every plan needs stabilization, but the rotational function is one of the most crucial and is intimately related to meniscal traumatisms [10].Bone remodeling and cartilage deterioration are two long-term negative effects of meniscus ablation. This revelation significantly altered the therapeutic a strategy for this prevalent job or sports injury[11].

MATERIALS AND METHODS

The study was conducted on 20 knee joints of formalin fixed cadavers in the Department of Anatomy, SBKSMIRC, Sumandeep Vidyapeeth Deemed to be University, Vadodara, Gujarat. We used Simple Random Sampling on sampling technique for collection of data. Operative and traumatic knee were excluded from the study. The parameters were observed twice in this study. All the measurements of Menisci were taken by Digital caliper. The thickness of menisci was measured in its three points**(Fig 1, Fig 2 & Fig 3)**and statistical analysis done by MS-Excel 2010 and statistical tools calculator.

Fig1: Showing the structures of menisci on Right Knee

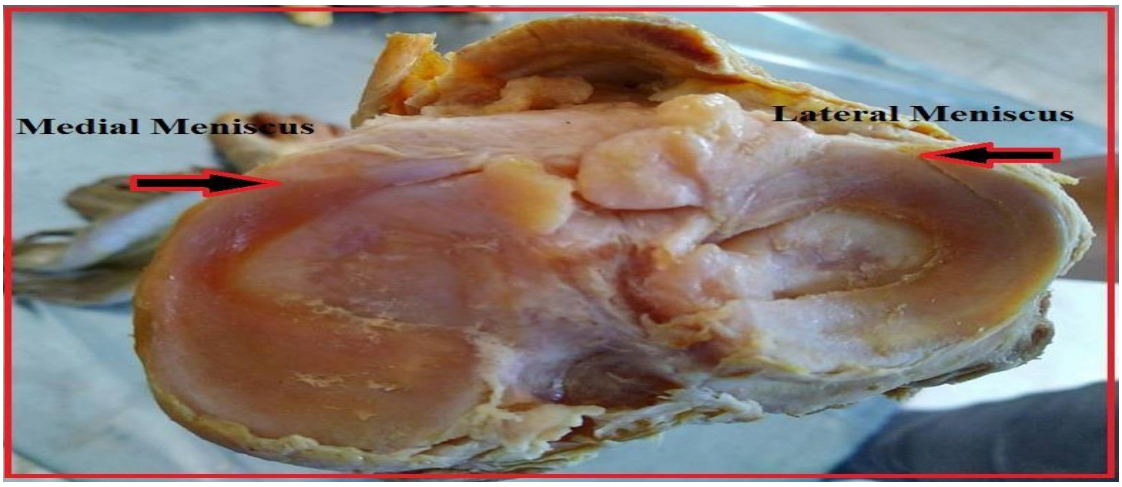

Fig2: Showing the measurements of menisci on Right Knee

[A] Measurements of Anterior 1/3rd of Lateral Meniscus of Right Knee

[B] Measurements of Middle 1/3rd of Lateral Meniscus of Right Knee

[C] Measurements of Posterior 1/3rd of Lateral Meniscus of Right Knee

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Fig3: Showing the measurements of menisci on Left Knee

[A] Measurements of Anterior 1/3rd of Lateral Mniscus of Left Knee

[B] Measurements of Middle 1/3rd of Lateral Mniscus of Left Knee

[C] Measurements of Posterior 1/3rd of Lateral Mniscus of Left Knee

Table 1: Showing the thickness of menisci on Right Knee

Observation	Thickness of Menisci on Right Knee					
	Anterior 1/3rd		Middle 1/3rd		Posterior 1/3rd	
	MM	LM	MM	LM	MM	LM
Min-Max (cm)	1.3-2.9	1.4-3.2	1.8-5.8	3.2-5.9	2.8-5.3	4.1-6.9
Mean ± SD	2.36 ± 0.39	2.15 ± 0.50	4.27 ± 0.94	4.98 ± 0.70	4.35 ± 0.73	5.56 ± 0.69
p- Value	0.1417		0.0029		0.0001	

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

Table 2 :Showing the thickness of menisci on Left Knee

Observation	Thickness of Menisci on Left Knee					
	Anterior 1/3rd		Middle 1/3rd		Posterior 1/3rd	
	MM	LM	MM	LM	MM	LM
Min-Max (cm)	2.1-5.6	1.5-5.6	3.7-8.4	3.0-5.9	3.4-7.5	4.2-6.6
Mean ± SD	3.2 ± 1.05	2.89 ± 0.95	5.18 ± 1.13	4.95 ± 0.73	5.2 ± 0.93	5.75 ± 0.59
p- Value	0.3542		0.4990		0.6155	

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Fig 4 : Showing the spreadness of data of both the menisci of Right Knee

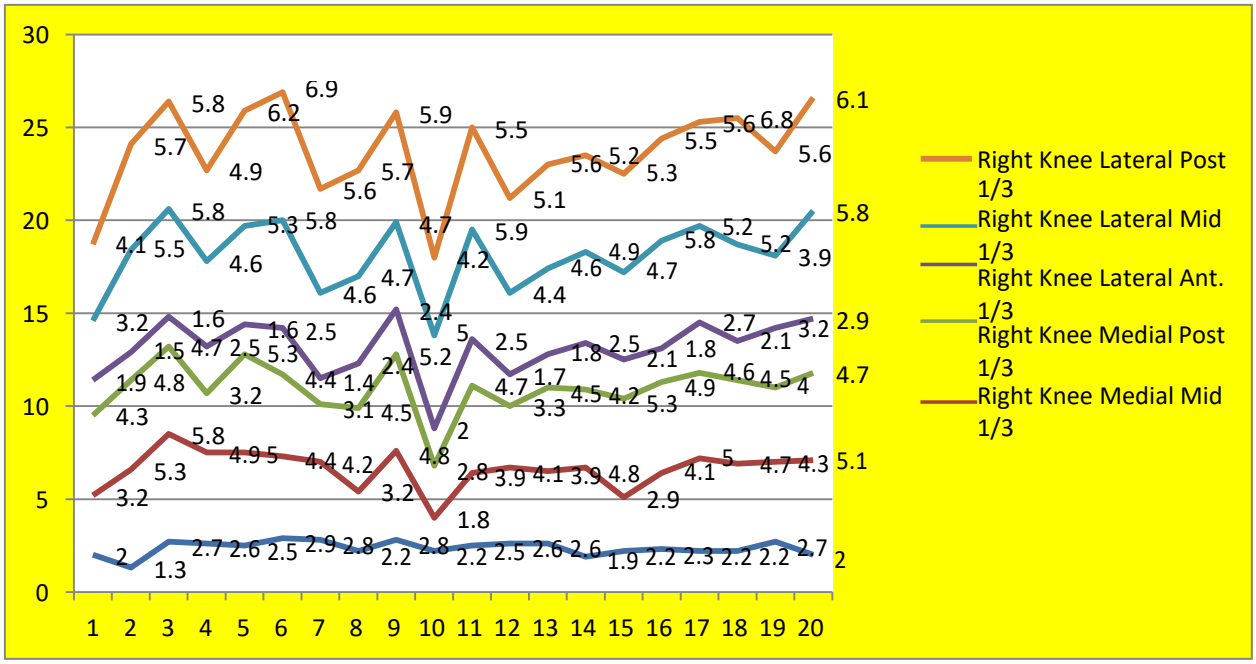
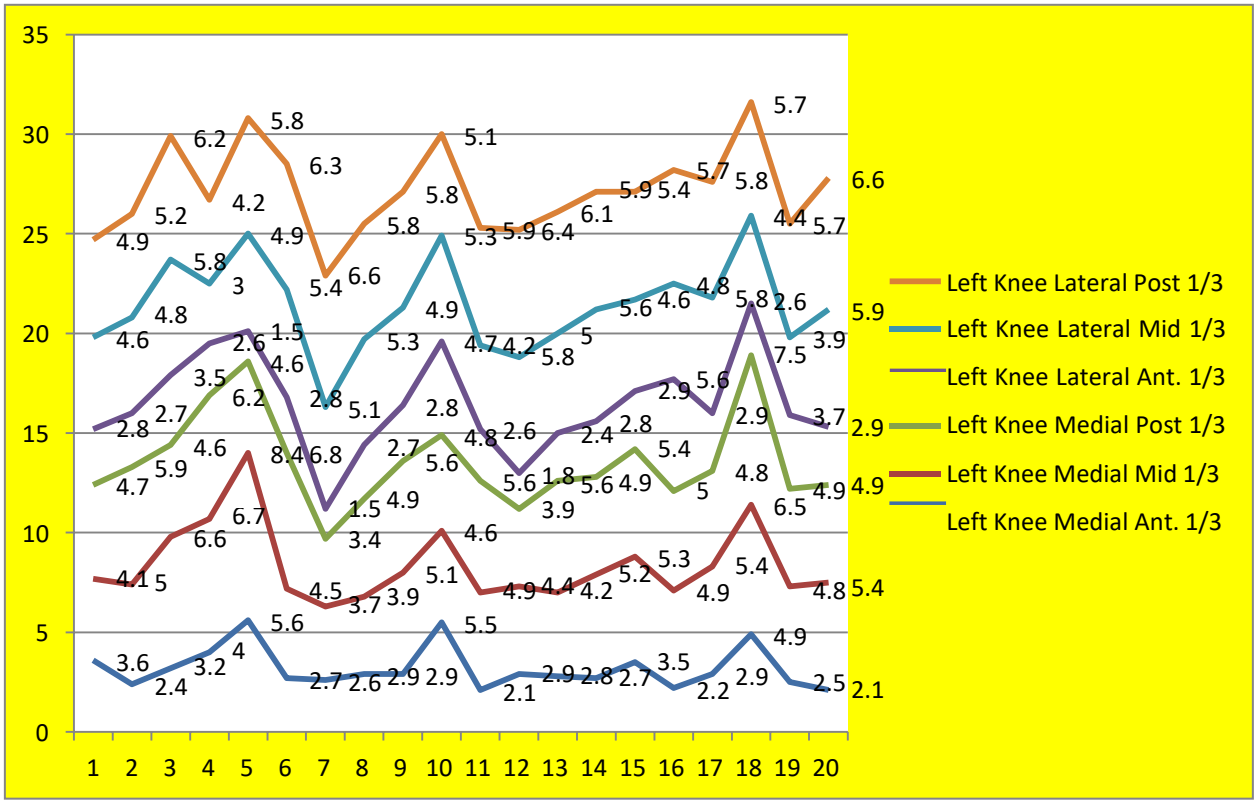


Fig 5 : Showing the spreadness of data of both the menisci of Left Knee



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RESULTS

The parametric distribution of thickness of medial meniscus onright knee of anterior 1/3rd, middle 1/3rd and posterior 1/3rd in which the Mean ± SD are 2.36 ± 0.39 mm, 4.27 ± 0.94 mm and 4.35 ± 0.73 mm respectively and lies in the range between 1.3-2.9, 1.8-5.8 and 2.8-5.3 whereas in lateral meniscus are 2.15 ± 0.50 mm, 4.98 ± 0.70 mm and 5.56 ± 0.69mm and they falls between 1.4-3.2, 3.2-5.9 and 4.1-6.9. The thickness of anterior 1/3rd of both the menisci of right knee are statistically not significant (**p>0.1417**) but the middle 1/3rd(**p<0.0029**) and posterior 1/3rd (**p<0.0001**) is statistically significant**(Table 1).**When we consider the parameters of thickness of medial meniscus on left knee of anterior 1/3rd, middle 1/3rd and posterior 1/3rd in which the Mean ± SD are3.2±1.05 mm, 5.18±1.13 mm and 5.2± 0.93 mm respectively and lies in the range between 2.1-5.6, 3.7-8.4 and 3.4-7.5 whereas in lateral meniscus are 2.89± 0.95 mm, 4.95± 0.73 mm and 5.75± 0.59 mm and they falls between 1.5-5.6, 3.0-5.9 and 4.2-6.6. The thickness of all the points of menisci between right and leftis statistically not significant (**p<0.3542**, **p<0.4990** and **p<0.6155**)**(Table2).**The spreadness of data on both the knees of both the menisci is shown in **Fig 4**and **Fig 5.**

DISCUSSION

One of the most delicate joint that is prone to injury is the knee joint. The construction of the knee joint imparts little stability, in contrast to the hip joint, which has a relatively stable ball-and-socket arrangement support for the stability of the joint. Due to this, the knee ligaments are vulnerable to damage from any stretching of the knee, such as from a forceful muscular contraction [12-14]. The thickness of cartilages isdiffering from anterior to posterior end[15-19].

Table 3 : Comparison of Medial and Lateral Menisci of Right Knee with other studies

Parameters		Present Study (2022)	Hathila et al[15] (2018)	Rao N et al[16] (2014)	Bhatt C.R et al [17] (2014)	Braz et al[18](2010)	Almeida KS et al [19](2004)
Thickness of Menisci (Medial)	Anterior 1/3rd	2.36 ± 0.39	6.21±0.6	5.6	5.82±1.44	6.17±1.68	5.92±1.37
	Middle 1/3rd	4.27 ± 0.94	6.18±0.55	5.4	5.64±1.26	6.31±1.73	5.31±1.06
	Posterior 1/3rd	4.35 ± 0.73	6.30±0.42	5.6	5.86±1.06	5.18±1.55	5.91±1.13
Thickness of Menisci (Lateral)	Anterior 1/3rd	2.15 ± 0.50	4.15±0.5	5.0	3.70±1.52	4.40±0.83	3.71±1.15
	Middle 1/3rd	4.98 ± 0.70	5.90±0.61	5.9	5.78±1.22	6.52±1.81	6.10±1.04
	Posterior 1/3rd	5.56 ± 0.69	5.63±0.60	5.7	5.20±0.98	5.46±1.19	5.29±0.78

In present study the thickness of both the menisci considered and measured from anterior to posterior end which reveals that the mean of medial meniscus on anterior, middle and posterior ends are 2.36 mm, 4.27 mm and 4.35mm while in lateral meniscus it was observed that 2.15 mm, 4.98 mm and 5.56 mm respectively which is slightly similar to study done by **Almeida KS et al** [19] were 5.92 mm, 5.31 mm and 5.91 mm in medial meniscus while in lateral meniscus were 3.71 mm, 6.10 mm and 5.29 mm respectively which is also supported the study done by **Rao N et al** [16] were 5.6 mm, 5.4 mm and 5.6 mm in medial whereas 5.0 mm, 5.9 mm and 5.7mm in lateral meniscus. **Bhatt et al** [18] done their study and reported that the mean are 5.82 mm, 5.64 mm and 5.86 mm in medial meniscus while 3.7 mm, 5.78 mm and 5.20 mm in lateral meniscus respectively.The studies done by **Hathila et al** [15] and **Braz et al** [18] slightly similar with each other and higher than the present study.

Conflict of Interest : None

Conclusion: The study is useful in meniscal replacement during the total knee replacement while performing the orthopedic surgery.

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