

## Study of Condylar Parameters of Tibiae An Analysis Pertaining to North Coastal Andhra Pradesh Population

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**Abstract:** Condylar and inter condylar parameters of tibiae of north coastal AP population is inadequately available in literature in order to formulate a baseline data useful for surgical utilities. This is very much useful for guiding clinicians in total knee replacement surgeries. Deformities of knee are not uncommon in this part of India.

**Materials And Methods:** Study was conducted in 100 dry human tibiae obtained from department of anatomy Rangaraya medical college Kakinada, KIMS Amalapuram. Measurements of medial and lateral condyles, intercondylar areas and circumference of upper end of tibia are meticulously recorded with the use of digital vernier calipers and were tabulated.

**Statistical Analysis:** Data collected has been restricted to analysis using are SPSS 20.0. Descriptive statistics are presented as mean, SD, parametric test student t test, variant analysis test (ANOVA) to see significance between mean values. The parameters would be considered when p value is less than 0.05.

**Keywords:** Tibia, medial condyles, lateral condyles, total knee replacement.

**Abbreviations:**

MAS - Medial articular surface

LAS - Lateral articular surface

ICA - Inter condylar area

NF – Nutrient foramen

NCAP- North coastal Andhrapradesh

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Date of Submission: 08 -08-2017

Date of acceptance: 23-08-2017

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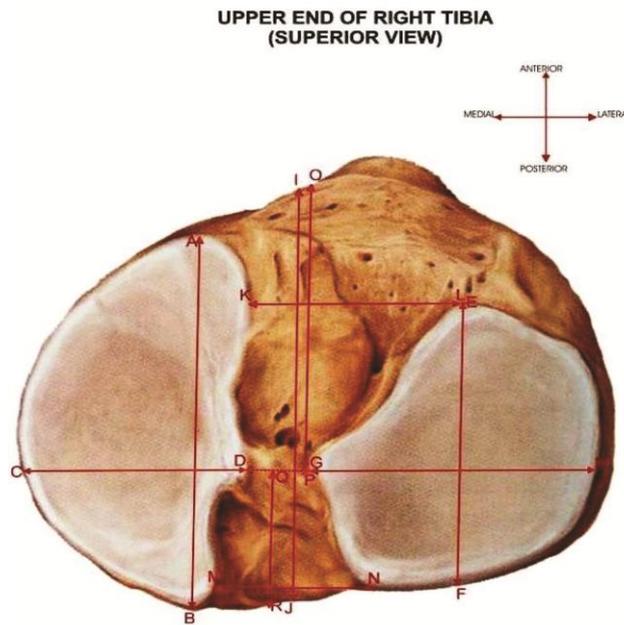
### I. Introduction

The bipedal erect posture of man caused a change in functional and mechanical measurements of skeletal structure so much so the lower limbs is primarily adopted for locomotion and weight bearing. As such the lower limb is primarily posted with great strength and stability when compared with upper limb (1). The lower limb of man is built up on the same plan of upper limb, however modifications for functional needs produced great significances in form and proportion population (2). Weight bearing is the main function of man when both knees are in fully extended posture. Because of the differing Weight bearing postures the parameters of upper end of tibia such as anteroposterior, medial and lateral dimensions at the diaphysio epiphyseal junction got well established. For an assessment of internal derangement of knee (IDK) morphometry of upper end of tibia is crucial as it provides reliable method of assement of disability. These parameters are useful for surgical procedures such as repair of ACL, PCL, and total knee replacement surgeries. For bringing an accurate tibial prosthetic design and to define tibial deformity the accurate morphometric parameters of upper end of tibia are of immense treasure for surgeons as well as biotechlogisists. Under these considerations, the present study of condylar parameters of tibiae of population of North coastal Andhra Pradesh population (NCAP) living being or cadaveric was undertaken so that it can enrich the meagerly available literature. As well as for interventional rheumatologist for implanting during osteonecrosis of medial or lateral tibial plateaus.

### II. Materials And Methods

Study is carried in 100 tibiae of both sides of adult age and equal number of both sides are available in the department of Anatomy RMC , Kakinada & KIMS , Amalapuram, A.M.C ,Visakhapatnam.(table1)

The following parameters are recorded:



1. AP length of superior articular surface of medial condyle (table1)
2. Width of superior articular surface of medial condyle (table1)
3. AP diameter of superior articular surface of lateral condyle (table1)
4. Width of superior articular surface of lateral tibial condyle (table1)
5. Width of intercondylar area (table1)
6. AP length of anterior intercondylar area (table1)

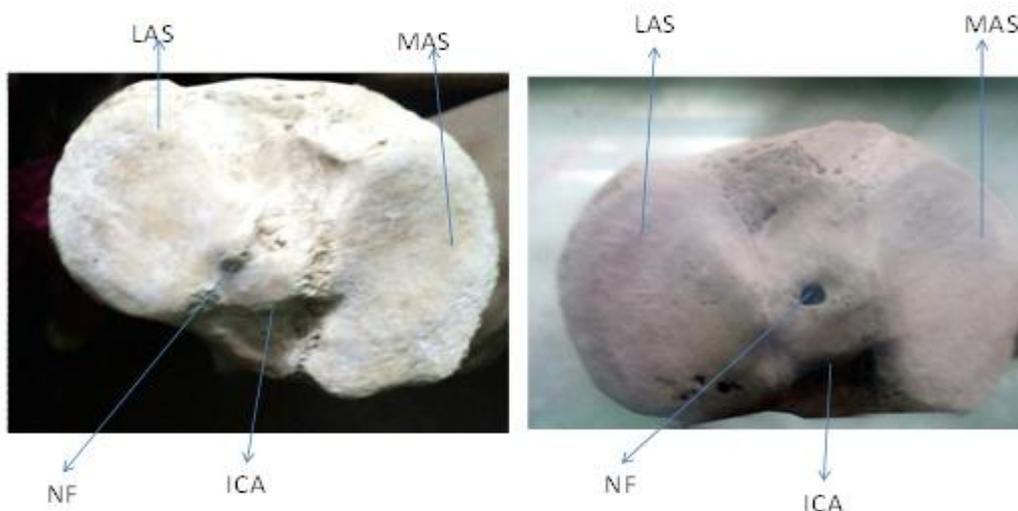


Fig no: 2 Showing LEFT TIBIA

7. AP length of posterior intercondylar area (table1)
8. Circumference of upper end of tibia (table1)

Table -1

Sl.no	Side of tibia	Ap length of superior articular surface of medial condyle(mm)	Width of superior articular surface	Ap length of superior articular surface of lateral condyle(mm)	Width of superior articular surface of lateral condyle(m	Width of intercondylar area(m	Length of intercondylar area(m	Circumference of upper end of tibia(mm)

			surface of medial condyle (mm)		m)	m)	m)	
1	Left	45	12	4	11	15	55	217
2	Right	40	15	36	12	18	50	192
3.	Right	43	14	41	12	20	55	192
4	Right	42	12	39	15	22	52	190
5	Left	44	12	40	10	12	49	195
6	Left	43	12	32	9	12	48	182
7	Left	40	10	36	11	13	45	182
8	Right	45	9	41	8	15	51	215
9	Left	42	12	38	13	14	45	190
10	Right	42	12	42	9	15	50	195
11	Right	45	10	35	13	10	40	170
12	Right	40	9	30	10	11	37	175
13	Left	42	10	39	11	16	44	185
14	Right	34	9	31	10	12	42	166
15	Right	39	13	40	11	13	46	194
16	Left	46	10	40	10	13	47	197
17	Left	46	12	42	14	15	46	206
18	Left	42	9	38	11	14	39	188
19	Left	41	11	41	10	17	48	202
20	Left	45	12	35	12	19	49	204
21	Right	46	13	42	13	18	52	196
22	Right	42	13	36	14	17	44	182
23	Right	42	16	38	14	20	40	181
24	Left	50	12	42	12	18	49	205
25	Left	50	15	40	13	22	48	190
26	Left	52	14	41	17	21	48	200
27	Left	42	16	41	16	18	44	182
28	Right	50	18	42	13	23	50	197
29	Left	45	12	44	12	18	46	185
30	Right	50	26	42	18	21	46	191
31	Left	52	13	40	12	17	48	188
32	Right	46	16	42	15	21	44	193
33	Left	50	15	45	15	20	50	205
34	Left	52	16	46	14	22	53	215
35	Right	50	12	35	11	17	47	180
36	Right	48	14	46	17	20	51	215
37	Right	41	12	31	12	16	35	174
38	Left	44	11	40	15	21	50	200
39	Right	50	14	41	12	20	48	190
40	Left	45	14	35	12	19	46	185
41	Right	51	16	45	14	21	47	200
42	Left	53	16	40	15	18	45	194
43	Left	54	17	48	17	21	50	205
44	Left	58	16	39	16	22	51	196
45	Left	48	15	35	14	15	39	185
46	Left	60	18	47	16	20	51	211
47	Left	56	15	42	15	18	50	205
48	Right	57	18	44	16	20	53	205
49	Left	50	15	40	15	23	45	185
50	Left	52	16	42	15	19	46	190
51	Right	55	30	43	35	18	50	200
52	Left	47	32	45	31	20	58	215
53	Right	50	37	45	35	18	58	205
54	Left	50	35	53	35	17	60	200
55	Left	55	33	42	36	20	67	210
56	Left	50	33	40	34	17	70	200
57	Right	49	35	45	35	20	60	199
58	Left	50	38	37	38	20	55	207
59	Right	42	27	38	28	18	53	173
60	Right	50	33	40	30	18	55	188
61	Right	38	29	40	33	18	52	180
62	Left	47	32	42	38	16	55	189
63	Right	38	28	40	30	15	43	163
64	Left	48	33	37	32	16	52	189
65	Right	58	40	48	40	17	70	220
66	Left	45	37	41	33	55	52	198

67	Right	42	33	42	35	21	65	190
68	Left	47	35	50	35	23	55	203
69	Left	45	30	36	30	18	50	174
70	Right	43	35	43	36	20	55	201
71	Left	45	35	47	37	20	57	200
72	Right	50	40	40	37	20	57	191
73	Left	46	33	43	33	18	53	198
74	Left	48	37	45	33	25	47	194
75	Left	4.5	38	43	33	17	55	203
76	Left	47	34	40	33	22	55	198
77	Right	45	35	40	30	20	55	190
78	Right	45	30	38	30	18	50	180
79	Right	50	33	40	37	20	60	193
80	Right	52	33	45	33	24	60	204
81	Left	52	35	45	37	20	64	210
82	Right	40	35	40	30	15	45	174
83	Right	46	31	45	25	15	57	200
84	Left	45	35	45	36	22	60	200
85	Right	42	35	40	24	16	60	188
86	Right	40	29	41	26	15	50	165
87	Left	50	35	40	35	17	56	196
88	Left	47	33	45	34	9	51	190
89	Right	45	35	36	28	10	46	173
90	Right	46	30	44	33	17	55	203
91	Left	50	32	50	37	27	60	203
92	Right	40	30	40	28	20	50	171
93	Left	34	25	36	30	14	45	170
94	Right	50	32	50	40	23	57	200
95	Left	53	34	47	35	11	56	204
96	Right	43	30	40	26	11	50	179
97	Left	45	32	39	25	16	50	188
98	Left	45	30	45	28	17	50	178
99	Right	44	33	37	27	15	62	190
100	Right	52	35	48	33	20	57	217

The available data is expressed as mean ± SD, followed by student t test on both right and left side tibiae and, p value has been considered significant. The results are compared with available literature.

### III. Observations

The mean values of AP measurements of medial condyle of tibiae of both sides are presented in table - 2. The difference between two sides is insignificant, even though the measurements of right side are greater than left tibial condyle and hence difference is statistically insignificant (p value <) table 2.

Table- 2.

S.no	Author	Race	Diameter	Side	Mean±sd	P value	
1	Servien et al	French	AP	-	50.8±3.3	-	
2	Swathi et al	North Indian	AP	R	M	48.45±4.4	<0.001
					F	42.39±4.19	
				L	M	47.23±4.32	
					F	40.36±4.65	
			TRANSVERSE	R	M	30.18±2.83	<0.001
					F	27.25±3.05	
				L	M	29.28±3.14	
					F	26.96±2.18	

3	Present study	North coastal Andhra Pradesh	AP	R	45.489±0.52	<0.05 (Significant)
				L	47.67±1.39	
			TRANSVERSE	R	24.27±1.01	>0.05 (Insignificant)
				L	22.509±1.04	

The transverse measurements on Right medial condyle is 24.277 where as on left medial condyle is 22.509 and it is statistically significant. (Table 3) On comparison of data of both condylar measurements. Right medial condyle measurements are significantly higher.

**Table -3** Comparison of data of both condylar measurements

Medial Condyle				Lateral Condyle	
Diameter	Side	Mean+SD	p value	Mean+SD	p value
AP	Right	45.48+0.523	<0.05	40.057+0.4257	>0.05
	Left	49.66+1.3937		41.547+0.4259	
Transverse	Right	24.277+1.0107	>0.05	23.26+1.02	>0.05
	Left	22.509+1.0491		22.38+1.048	
Circumference Upper end	Right	127.00+1.276715	<0.05	118.6809+0.8251	<0.05
	Left	131.6226+1.135481		119.0566+0.869517	

**Intercondylar area:**

The intercondylar area is flat and devoid of any tubercles/ prominences in 15 tibiae of both sides out of 50 under study. The mean length of intercondylar area on Rt tibia is 51.4 and the width is 17.64 where as on left tibia the mean length is 51.037 and the width was 18.641 the difference being statistically insignificant inspite of the fact intercondylar area measurements are slightly more on right than left.

**Table- 4** Comparison of measurements of intercondylar area

Author	Race	Right		Left		
		length	breadth	Length	Breadth	
Kwak et al	Korean	47.3±3.8 (Surface area)	-	-	-	-
Swathi et al	North Indian	47.19± 2.93	17.44(M)± 0.1414 (SD)	49.11±3.97		
Present study	North coastal AP	51.319±0.7190	17.7021±0.3438	51.0754±0.6250	18.6603±0.623	<0.05

**IV. Discussion**

The data of present study will be of immense help as the morphometric indices of upper end of tibiae of NCAP population is not available in particular. Quite a few authors like Servien et al(4), noted the condylar measurements of upper end of tibiae Jacobsen et al(1974) (1) obtained data of intercondylar area of tibia and studied the applications of radiography. Servien et al studied on medial and lateral tibial plateau and analyzed the adoptability of tibial component design. DS kwak et al (2007) (5) studied upper end of tibia to design the tibial component of total knee arthroplasty in Korean population. F.B.Chang et al (2009) (6) brought in to light the three dimensional morphometry of the knee to design the total knee arthroplasty in Chinese population. JC Kennedy et al (7) worked on the stability of knee using stress mechanics. S. Zanasi (2011) (8) brought in new trends in operative treatment and changes in innovations of total knee replacement. Swathi et al (2014) (9) made a study as morphometric analysis of upper end of tibia in north Indian population with regard to taking sex factor into consideration while making a prosthesis and analyzed the tibial plateau for planning unicompartmental knee arthroplasty. Data obtained in the present study definitely help for provision and design an optimal tibial component for arthroplasty of north coastal Andhrapradesh. It is time that earlier authors who

studied tibial plateau whether it is in French, Chinese and Korean populations independent of sex and side. A statistical comparison of Korean, north Indian and present study of north coastal AP population, transmitted an impression that the surface area of Korean and north Indian population almost considered where as the statistical data is definitely more and the surface area of intercondylar area is more than of earlier studies. The intercondylar area is flat and devoid of any tubercles in 15 of the 50 tibiae under study. This is useful in designing prosthesis (chang et al). As is well known osteoarthritis of knee is common disability due to damage of complete and integrated structures may be due to mechanical forces, familial and genetic causes. This condition for is the most common condition for knee replacement totally. It is the standard treatment of present day giving a pain free stable knee to the patient that ensures better life to the affected individual.

In total knee replacement about 9mm of tibial and femoral articular surfaces are sacrificed and the same is replaced with metal caps to give a greater longevity. Hence proper designing of prosthesis for patients of north coastal AP population who require total knee replacement procedure the present analytical study will be of immense help and provides a basis for preparation of appropriate prosthesis keeping in view of a flat intercondylar plateau in particular and that this study will be extremely beneficial to biotechnologists involved in prosthesis and compartmentalization of knee in NCAP population.

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\*Dr. A. Vasanthi. " Study of Condylar Parameters of Tibiae An Analysis Pertaining to North Coastal Andhra Pradesh Population." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)* 16.8 (2017): 04-09