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Analysis Of The Effect Of Osteoporosis On Varus Alignment Of End Stage Knee Osteoarthritis

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The authors have no conflicts of
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Introduction

- ❖ Knee Osteoarthritis (KOA): varus deformity is common
 - In varus knee, proximal deformity is common cause
 - It is not known why tibia deformity is more common than femur deformity
- ❖ Osteoporosis is common in KOA
 - Osteoporosis is associated with varus deformity
- ➔ Osteoporosis can induce proximal deformity



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Hypothesis

- ❖ BMD between the distal femur and proximal tibia is different
- Distal femur is stronger than proximal tibia.
- ❖ There is a relationship between the degree of medial tibial collapse and the knee BMD.



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Methods

- ❖ Patients with end-stage KOA who were hospitalized for total knee arthroplasty (TKA) at our hospital (March 2019 ~ February 2022)
- ❖ Inclusion
 - Varus alignment
 - CT, BMD measurement before TKA
- ❖ Exclusion
 - Previous fracture
 - Previous arthroplasty or osteotomy



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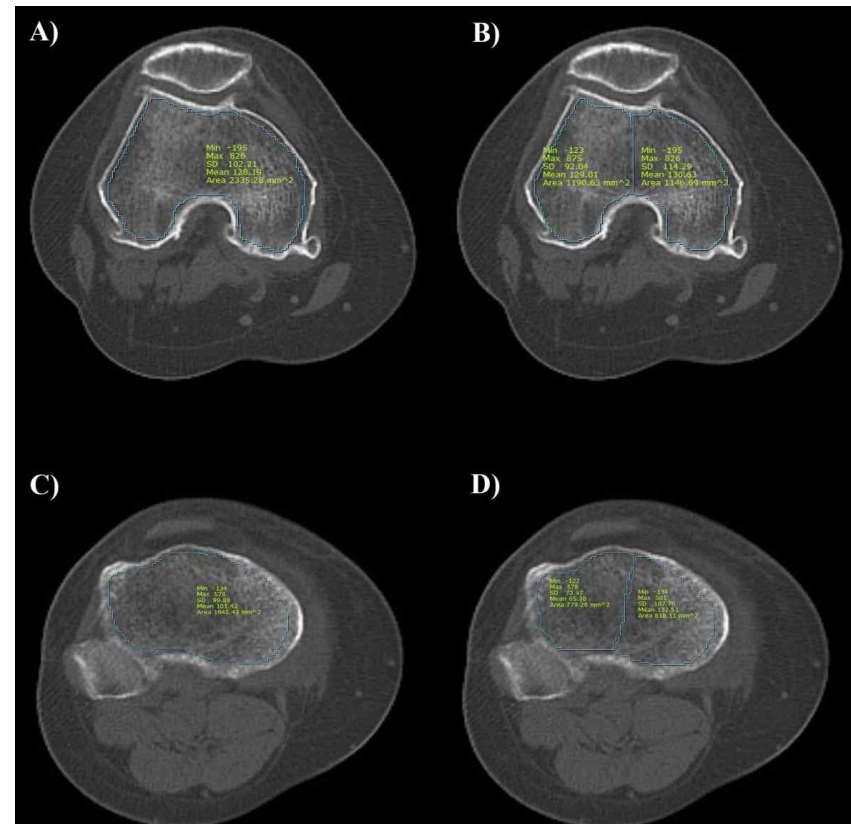
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BMD measurement

❖ BMD in DEXA

- Lowest T-score L-spine 1–4
- Lowest T-score among two or more averaged T-scores from the L-spine 1–4
- Femur neck T-score
- Femur total T-score

❖ CT: Housfield unit (HU)



Varus measurement

- ❖ Hip knee ankle (HKA) angle
- ❖ Medial proximal tibial angle (MPTA)
- ❖ Lateral distal femoral angle (LDFA)
- ❖ Joint line congruency angle (JLCA)



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Result

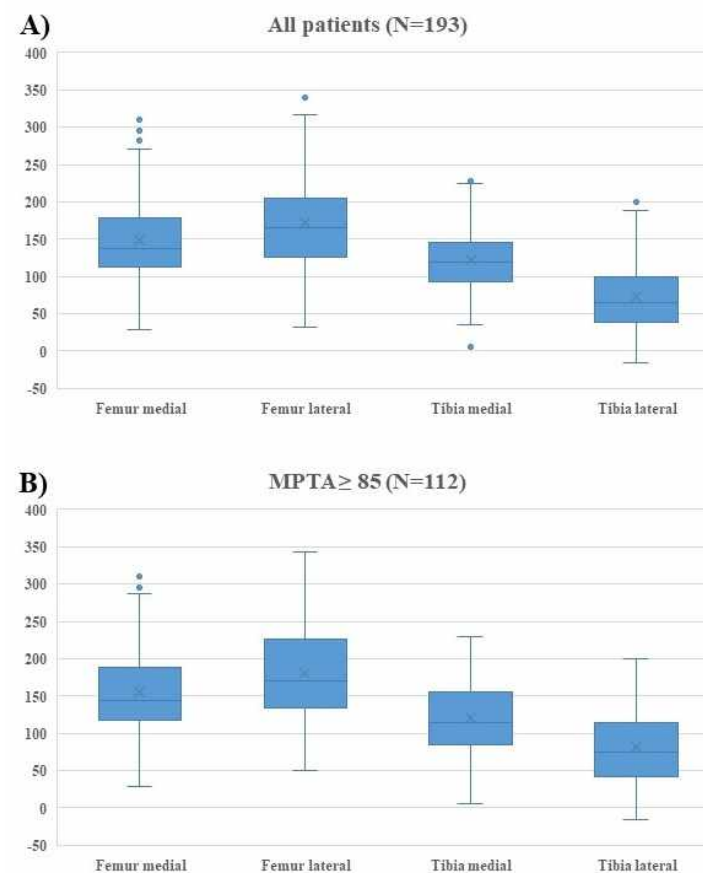
Patients demographics of included patients							
	MPTA \geq 85° (N=112)			MPTA < 85° (N=81)			
	Average	SD	ICC	Average	SD	ICC	p-value
Age	74.04	4.73		74.25	5.36		0.782
Sex	Male: 55 Female: 57			Male: 32 Female: 49			0.192
Height	158.18	7.63		156.02	8.17		0.061
Weight	68.68	13.69		64.25	12.41		0.022
BMI	27.36	4.09		26.37	4.54		0.117
MPTA	87.01	1.57	0.82	82.82	1.92	0.84	>0.001
JLCA	4.66	2.13	0.80	4.66	2.34	0.82	0.1
LDFA	88.50	1.85	0.75	89.05	2.39	0.80	0.064
HKA angle	6.75	2.99	0.90	11.65	4.51	0.86	>0.001

Result

-BMD difference around knee joint-

	Housefield unit		
	Mean	SD	ICC
All Patients (N = 193)			
Femur medial	148.44	50.74	0.88
Femur lateral	171.48	61.73	0.86
Tibia medial	121.88	43.13	0.79
Tibia lateral	73.61	44.76	0.82
MPTA $\geq 85^\circ$ (N=112)			
Femur medial	154.27	56.92	0.90
Femur lateral	179.18	66.46	0.89
Tibia medial	120.71	48.98	0.81
Tibia lateral	80.81	47.66	0.85

❖ Significant difference in 4 groups
(repeated ANOVA, $p < 0.001$)



Result

-BMD difference according to MPTA-

Table 3. Difference in housefield unit between two groups

	Group 1	Group 2	p-value
Femur medial (HU)	154.45 ± 56.11	140.13 ± 41.10	0.053
Femur lateral (HU)	180.63 ± 65.46	158.82 ± 54.05	0.015
Femur total (HU)	165.21 ± 59.04	147.70 ± 45.36	0.027
Tibia medial (HU)	121.24 ± 48.52	122.78 ± 34.58	0.808
Tibia lateral (HU)	80.16 ± 47.98	64.57 ± 38.34	0.017
Tibia total (HU)	100.24 ± 45.39	91.90 ± 34.02	0.164
BMD L-spine (T-score)	-0.86 ± 1.59	-1.03 ± 1.64	0.493
BMD L-spine_2 site (T-score)	-0.50 ± 1.67	-0.75 ± 1.66	0.314
Femur neck (T-score)	0.90 ± 1.19	-0.13 ± 1.10	0.016
Femur total (T-score)	-0.53 ± 1.31	-0.89 ± 1.15	0.049
Femur medial & femur lateral difference (HU)	-26.13 ± 29.81	-18.69 ± 29.46	0.085
Tibia medial & tibia lateral difference (HU)	41.08 ± 33.01	58.21 ± 29.37	<0.001
Femur medial & tibia medial difference (HU)	32.21 ± 34.69	17.36 ± 35.03	0.002
Femur lateral & tibia lateral difference (HU)	100.47 ± 38.51	94.25 ± 33.44	0.244
Femur total & tibia total difference (HU)	64.96 ± 33.56	55.80 ± 30.17	0.052

Limitation

- ❖ Cross-sectional study: could not confirm the progression of proximal tibial deformation according to osteoporosis
- ❖ HU measured in the medial tibia had errors → tibial medial HU was not used in the interpretation of the results of this study
- ❖ Only deformation around knee were considered → proximal femur, distal tibia deformity were not considered



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Conclusion

- ❖ Medial tibia collapses more than the medial femur in varus alignment end-stage KOA
- BMD of the proximal tibia is lower than that of the distal femur
- ❖ In MPTA collapse group, the T-scores of the DEXA femur and the HU measured by CT were low
- MPTA collapse was affected by the absolute value of BMD rather than by the relative difference in BMD between the distal femur and proximal tibia.



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