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# Meniscal Ramp Lesion a contact characteristic in cadaver

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# Disclosure

The authors had no conflict of interest to disclose.

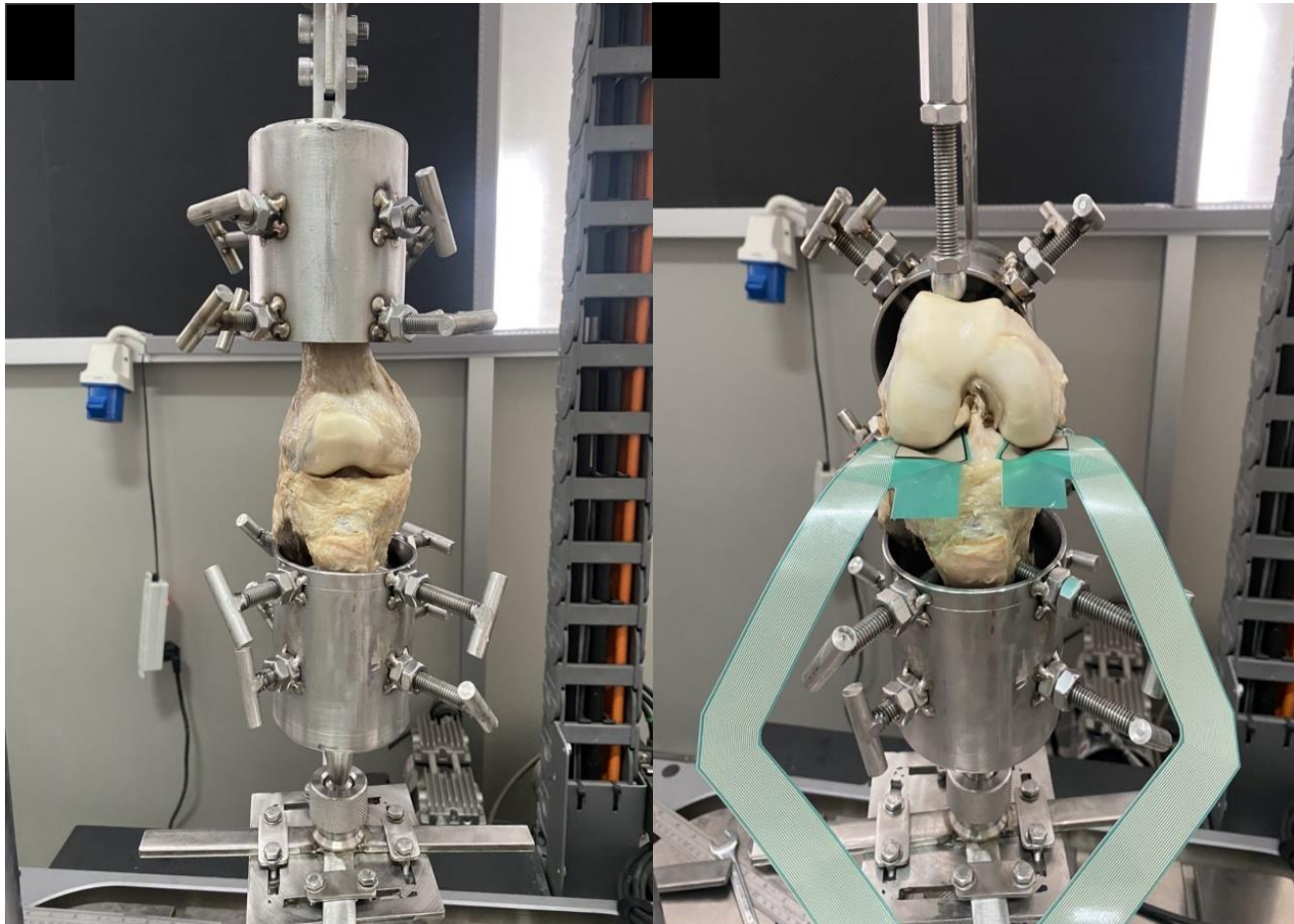
# Background and Objectives

- Meniscal ramp lesions are characterized by an increase instability particularly in ACL-deficient knees.
- The study shows the meniscotibial injury and the meniscal remnant of the posterior horn can float and expose the tibial plateau.

## Objective

- To analyze the contact characteristic change of tibiofemoral joint that occur with an unstable ramp lesion of medial meniscus.
  - **Peak contact pressure [Primary outcome]**
  - Joint contact area
  - Joint contact pressure
- At 0, 45, 90 degrees of knee flexion compare with **intact, ramp lesion, root lesion** and **combined root lesion with ramp lesion**.

# Materials and Methods

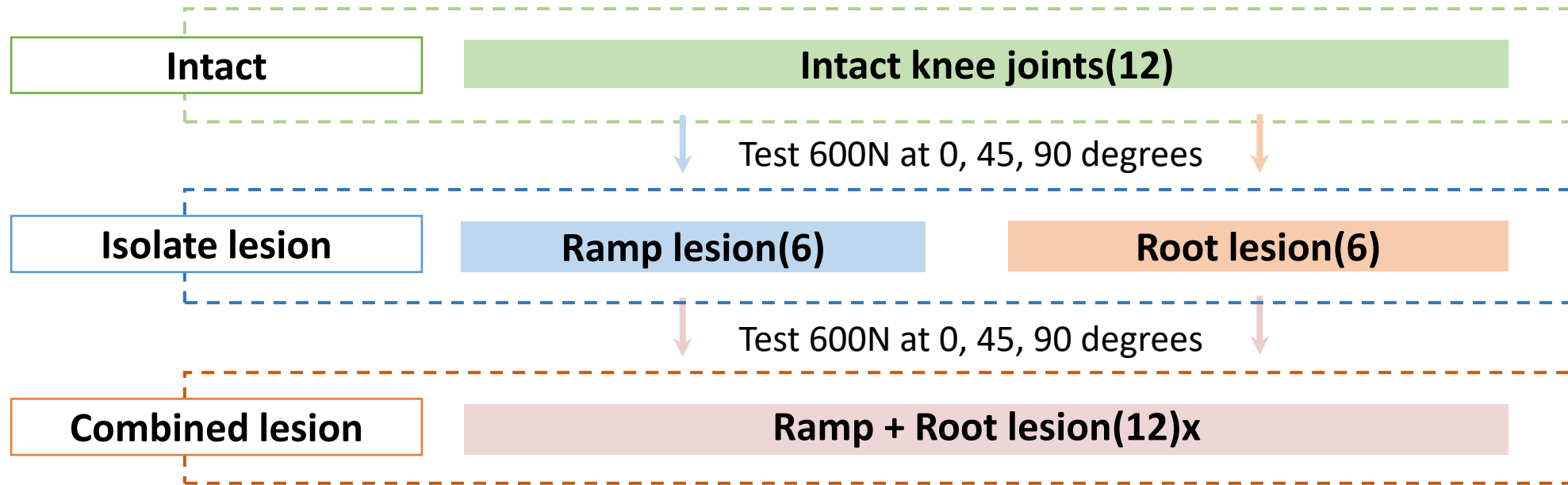


12 Embalmed Cadaveric knees  
(Matched pairs)  
4 Males, 2 Females  
Median age: 66 years (44-79)

- Embalmed human cadaveric knees.
- The knee joint is mounted in a custom testing jig.
- Allowed positioning of the knee at 0°, 45°, and 90° flexion.

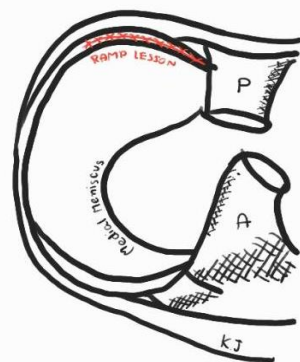
The collateral ligament, PCL and posterior structure were preserved.

# Materials and Methods

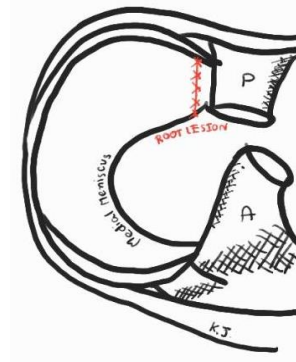


Complete vertical meniscocapsular junction cut and horizontal meniscotibial ligament cut, both 25 mm long, beginning adjacent to PCL

**Ramp**

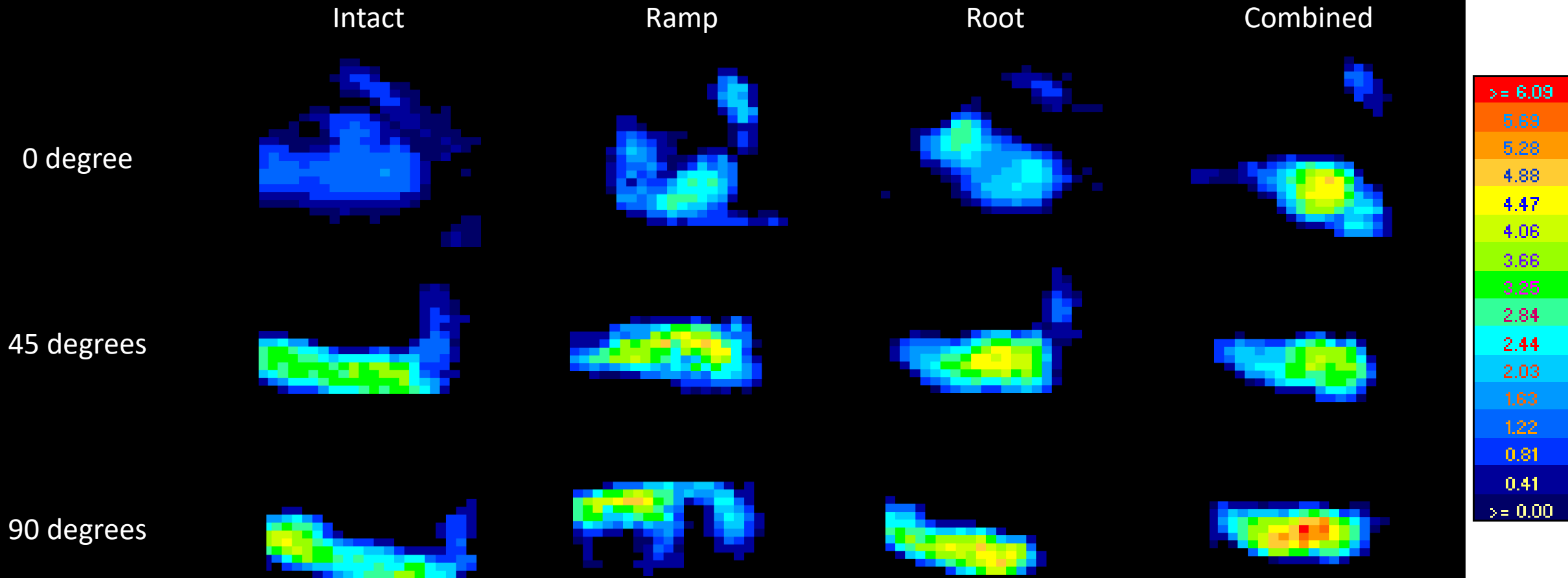


**Root**



A complete radial cut of the posterior root medial meniscus, 3 mm from the medial boarder of PCL insertion.

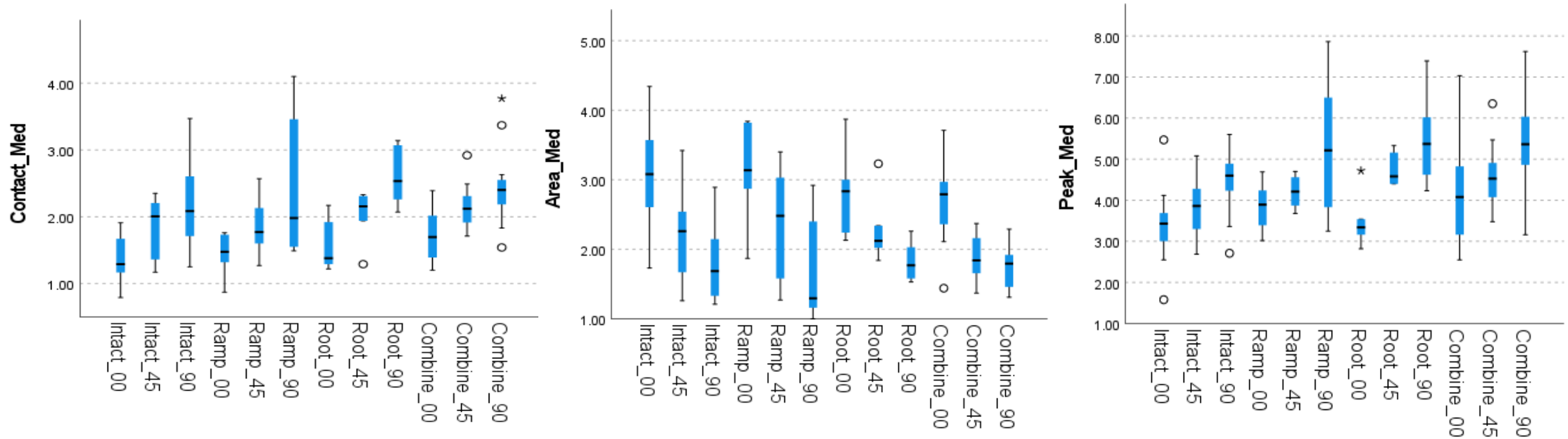
# Results



Testing Condition	Knee flexion	Force (N)	Contact area (cm <sup>2</sup> )	Contact Pressure (MPa)	Peak contact pressure (MPa)
Intact	0 degree	407.9 ± 72.5	3.08 ± 1.06	1.29 ± 0.53	3.43 ± 0.73
	45 degrees	378.7 ± 109.6	2.26 ± 0.99 <sup>a</sup>	2.01 ± 0.89 <sup>a</sup>	3.86 ± 1.09
	90 degrees	386.7 ± 111.6	1.69 ± 0.89 <sup>a</sup>	2.09 ± 1.12 <sup>a</sup>	4.60 ± 0.80 <sup>a</sup>
	Average	397.7 ± 92.0	2.27 ± 1.35	1.78 ± 0.91	3.86 ± 1.32
Isolated ramp lesion	0 degree	424.5 ± 211.0	3.34 ± 1.20	1.48 ± 0.53	3.90 ± 1.05
	45 degrees	452.3 ± 179.0	2.48 ± 1.62	1.77 ± 0.72	4.21 ± 0.77
	90 degrees	405.7 ± 155.8	1.30 ± 1.41 <sup>a</sup>	1.98 ± 2.09 <sup>a</sup>	5.22 ± 3.16 <sup>a</sup>
	Average	419.6 ± 148.8	2.48 ± 1.73	1.72 ± 0.68	4.15 ± 0.98
Isolated posterior root lesion	0 degree	393.8 ± 132.9	2.84 ± 1.00	1.38 ± 0.71	3.34 ± 0.76
	45 degrees	446.6 ± 76.6	2.12 ± 0.59	2.16 ± 0.54 <sup>a</sup>	4.58 ± 0.80 <sup>a</sup>
	90 degrees	466.0 ± 55.1 <sup>a, b</sup>	1.77 ± 0.52 <sup>a</sup>	2.54 ± 0.88 <sup>a</sup>	5.37 ± 1.84 <sup>a</sup>
	Average	451.2 ± 81.3 <sup>b</sup>	2.17 ± 0.87	2.12 ± 0.92	4.58 ± 1.70 <sup>b</sup>
Combined ramp and root lesion	0 degree	444.4 ± 119.9	2.79 ± 0.66	1.70 ± 0.68	4.08 ± 1.76
	45 degrees	401.2 ± 49.9	1.84 ± 0.56 <sup>a</sup>	2.12 ± 0.44 <sup>a</sup>	4.53 ± 0.89 <sup>a</sup>
	90 degrees	437.9 ± 117.7 <sup>a</sup>	1.80 ± 0.50 <sup>a</sup>	2.40 ± 0.43 <sup>a</sup>	5.37 ± 1.43 <sup>a</sup>
	Average	413.8 ± 96.0	2.00 ± 0.76	2.13 ± 0.67 <sup>b</sup>	4.67 ± 1.47 <sup>b</sup>



# Results



The **angle of knee flexion** considerably affected the contact area and contact pressure of the medial compartment.

As the degree of flexion of the tibiofemoral joint increased, the contact area in the medial compartment decreased, resulting in an increase in contact pressure.



# Discussions

- The meniscal ramp lesion increased peak contact pressure compared with the intact knee but did not significantly increase compared with the meniscal root lesion.
- Multiple studies have demonstrated variable results in alteration of knee kinematics depending on the characteristics of the lesions
- The knee flexion angle is the important factor that is associated with contact characteristic change in all conditions.
- Previous studies demonstrated a ramp lesion without subluxation have negligible influence on knee kinematics and ramp lesion repair did not alter in situ forces in the ACL in the critical range between full extension and 30 degrees knee flexion.
- Limiting knee motion in full extension may keep the lesion more stable.

# Conclusions

- This study demonstrated no significant changes in peak contact pressure, force transmission, contact area, and contact pressure in isolated ramp lesions
- The knee flexion angle is the important factor that substantially increases contact pressure, especially in ramp and root lesion.

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