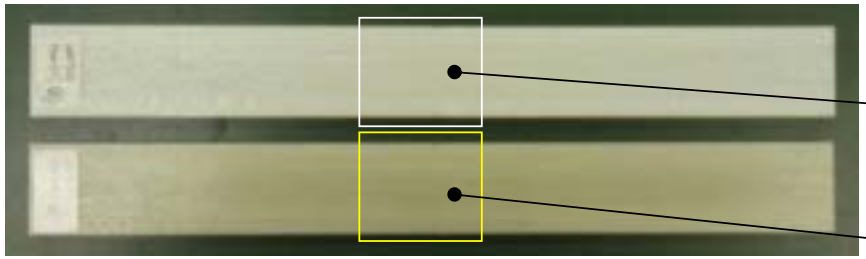
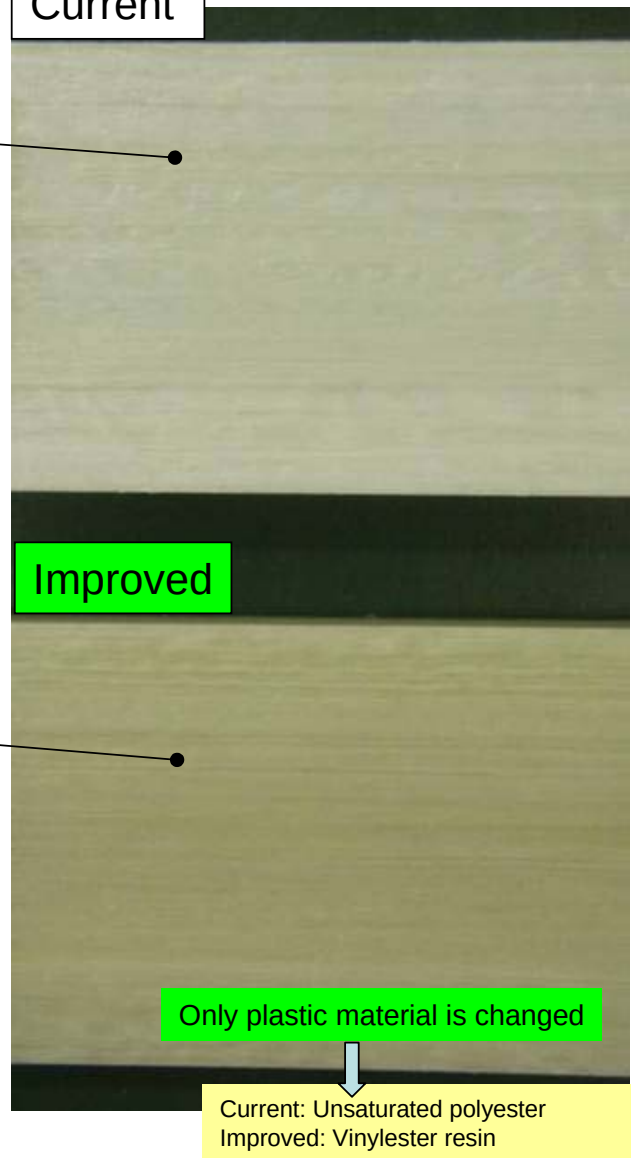
Improvement of Durability of Bone Core





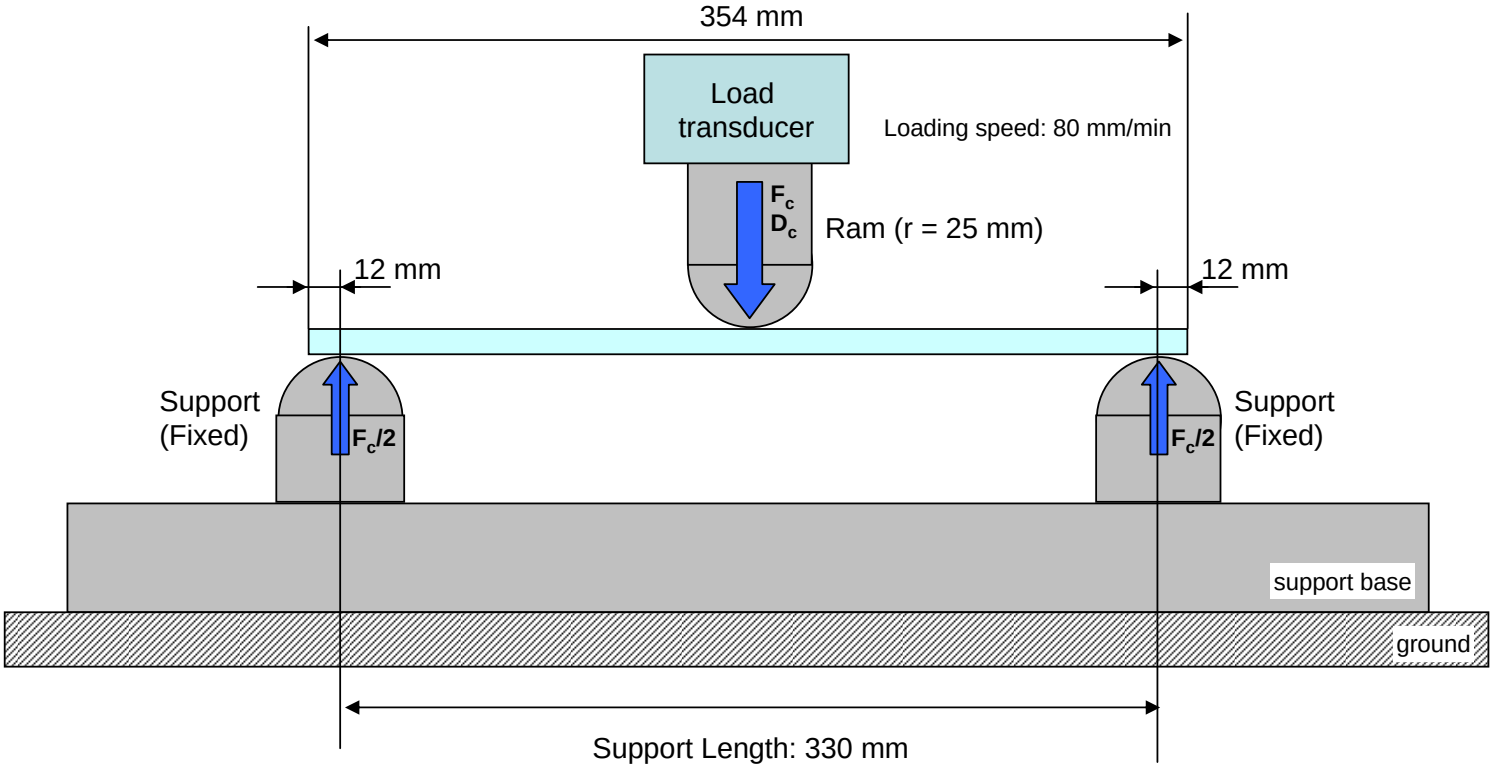
Background

- Recently, many of user wants to use Flex-PLI, so to be **damaged the bone core is very unfavorable** especially during evaluation tests of impactor.
- Moreover, Flex-GTR has to use both sides of strain gages at the same time to measure bending moment, so only **one side of strain gage damage is critical**.
- Therefore, **we tried to improve durability of bone core as we can possible** by using different plastic material of bone core (glass fiber material is the same).

Overload tests for both bone cores

Test Method (overload test)

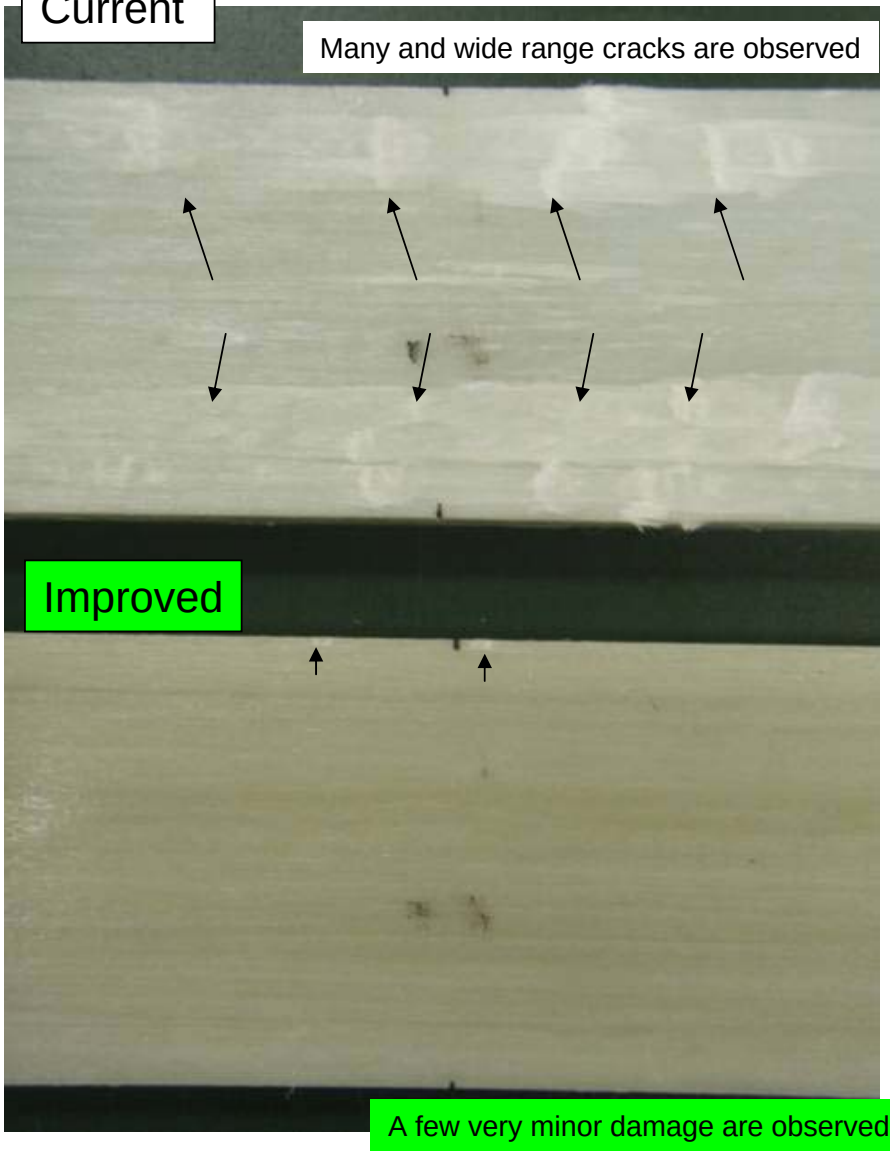
Femur Bone Core
Quasi-static 3-Point Bending Test

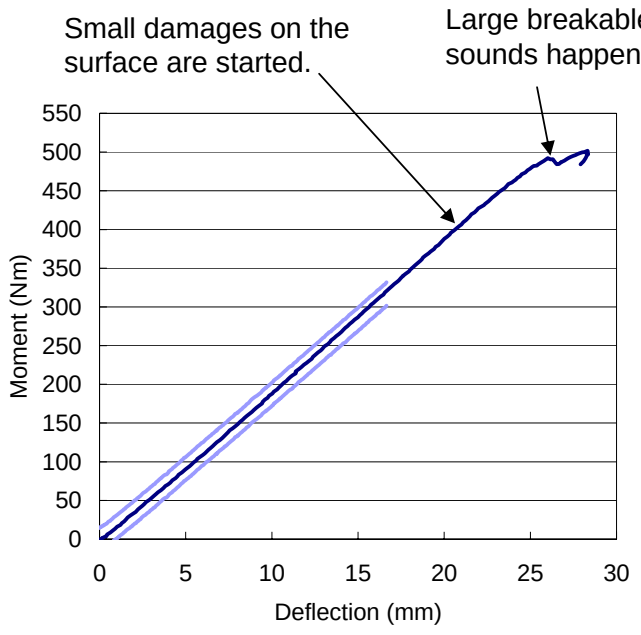


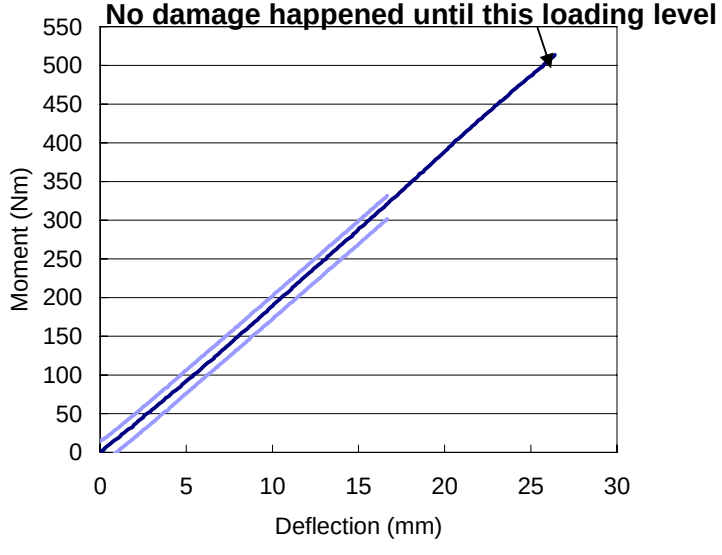
F_c: Force Center, D_c: Deflection Center
M_C : Moment Center (Nm) = F_c /2 (N) x 0.165 (m)

Bone Core Surface Conditions (After 500 Nm is applied)

Current



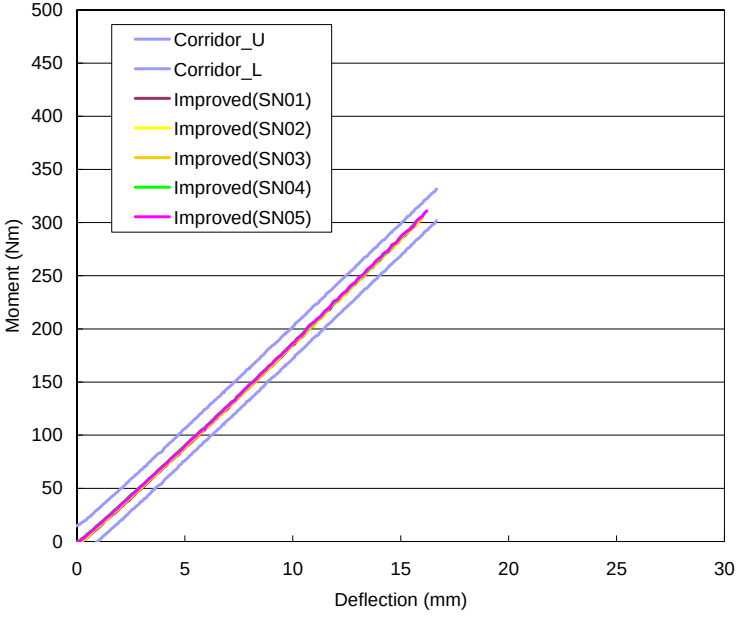


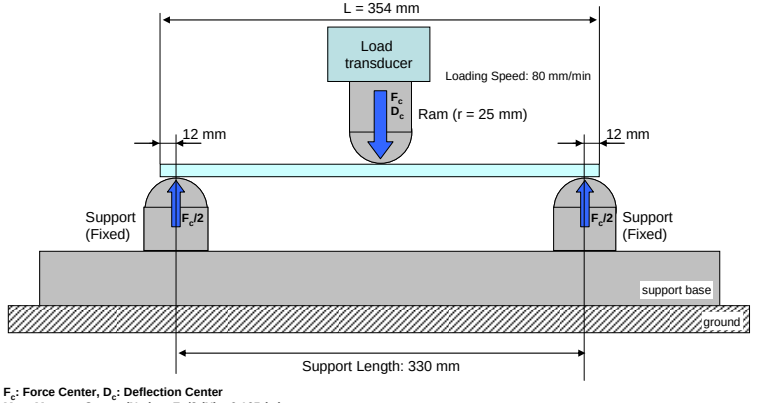


Comparisons for the both bone cores responses

Quasi-static 3-Point Bending Characteristics of Improved Bone Cores (SN01-05)

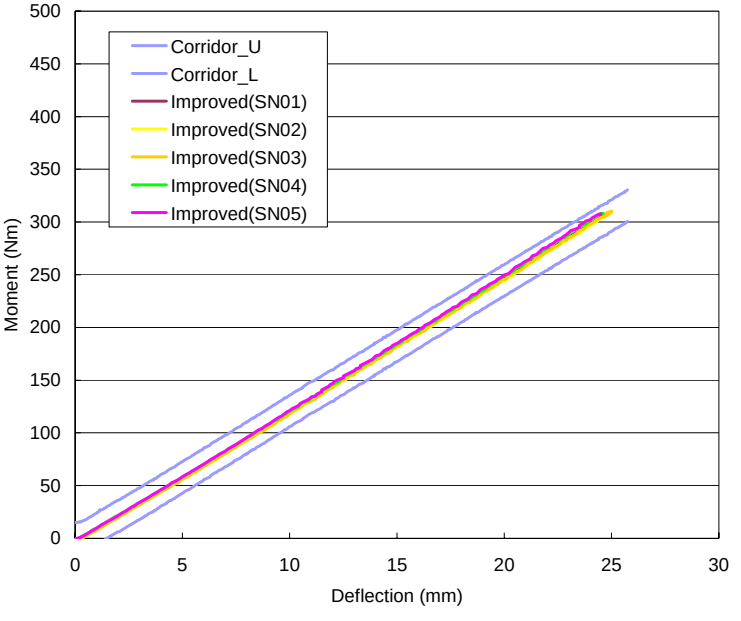
Quasi-static 3-Point Bending Test
Femur Bone Core: Improved SN01-SN05

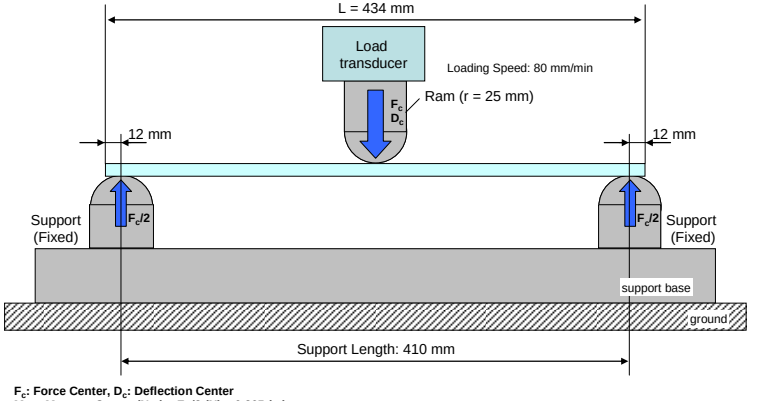




F_c: Force Center, D_c: Deflection Center
M_c : Moment Center (Nm) = F_c /2 (N) x 0.165 (m)

Quasi-static 3-Point Bending Test
Tibia Bone Core: Improved SN01-SN05

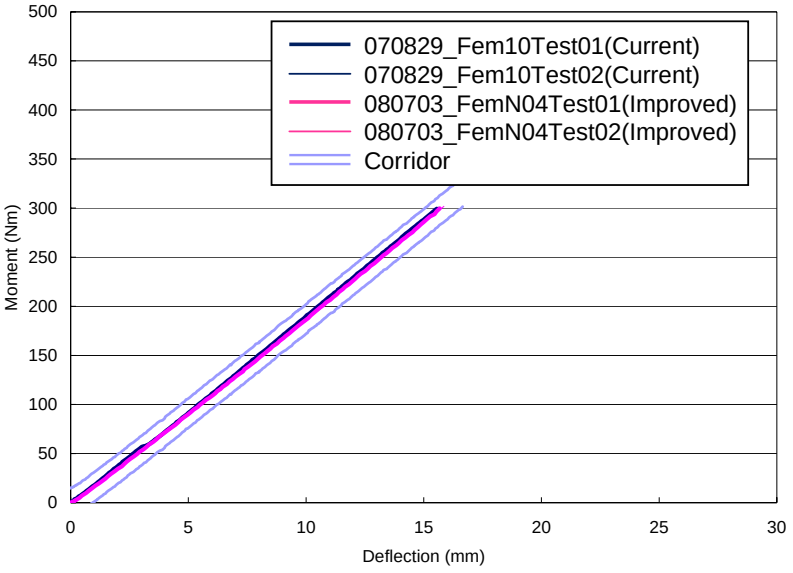




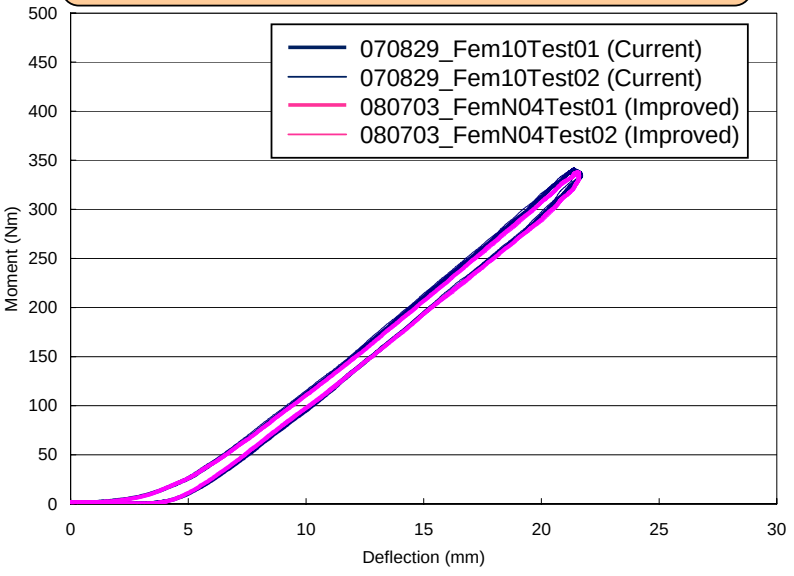
F_c: Force Center, D_c: Deflection Center
M_c : Moment Center (Nm) = F_c /2 (N) x 0.205 (m)

Comparison of Bending Characteristics of Current and Improved Bone Cores

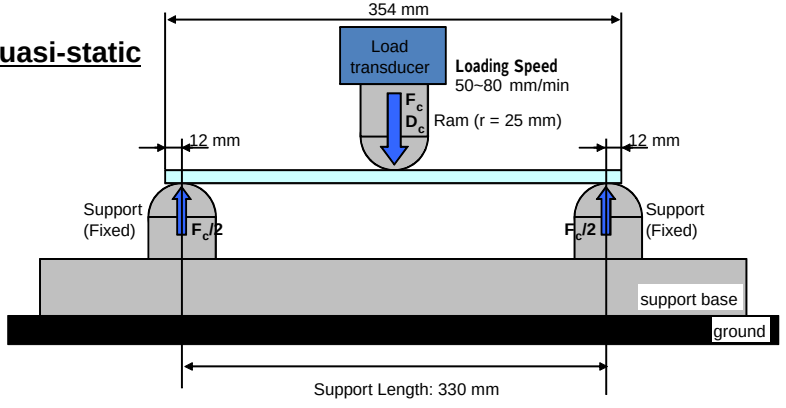
Quasi-static 3-Point Bending Test Femur Bone Core



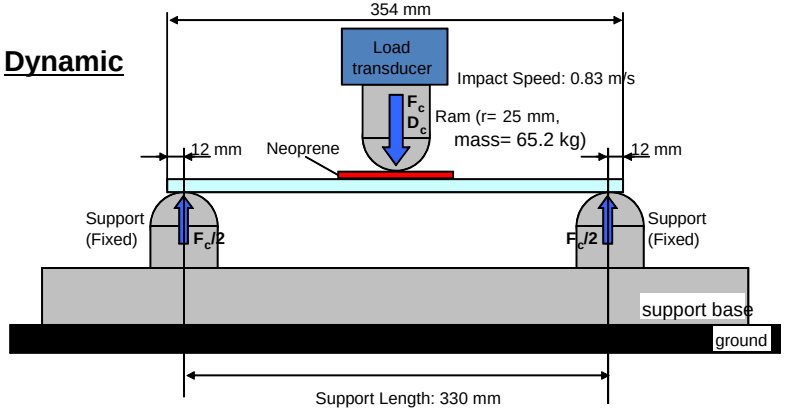
Dynamic 3-Point Bending Test (Drop Test) Femur Bone Core



Quasi-static



Dynamic

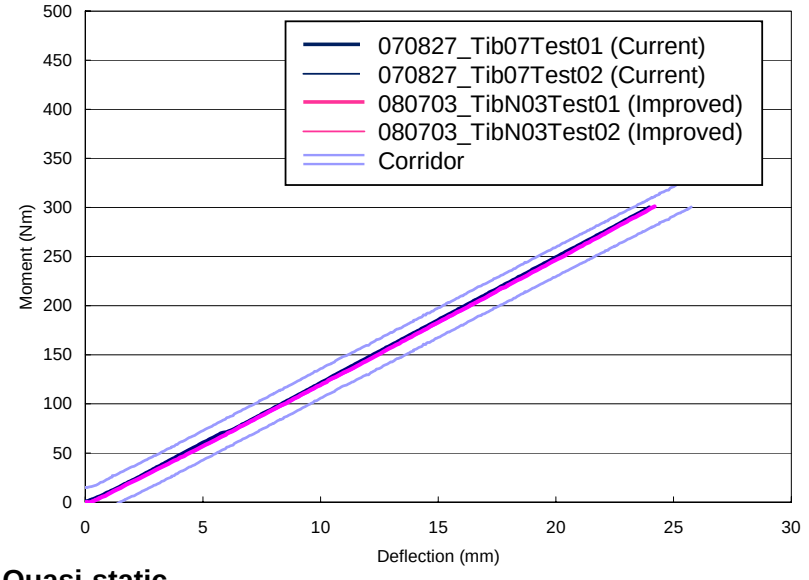


F_c: Force Center, D_c: Deflection Center
M_c : Moment Center (Nm) = F_c/2 (N) x 0.165 (m)

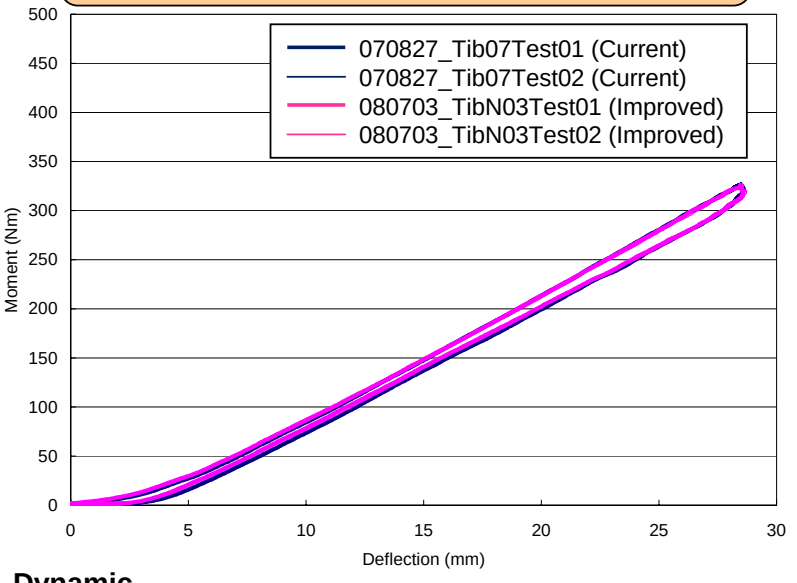
F_c: Force Center, D_c: Deflection Center
M_c : Moment Center (Nm) = F_c/2 (N) x 0.165 (m)

Comparison of Bending Characteristics of Current and Improved Bone Cores

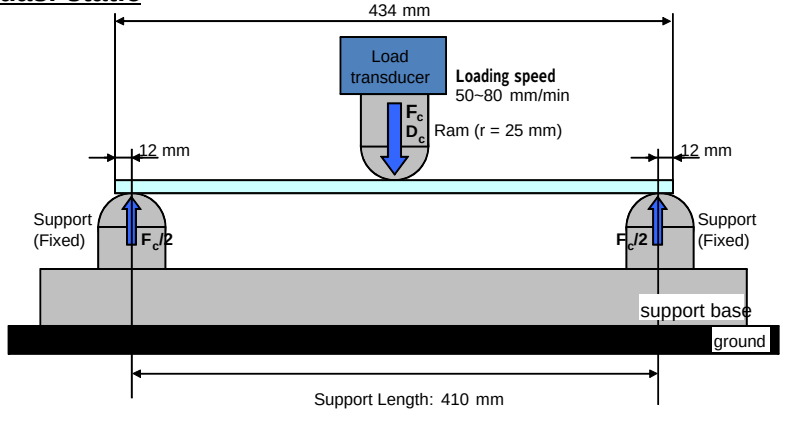
Quasi-static 3-Point Bending Test Tibia Bone Core



Dynamic 3-Point Bending Test (Drop Test) Tibia Bone Core

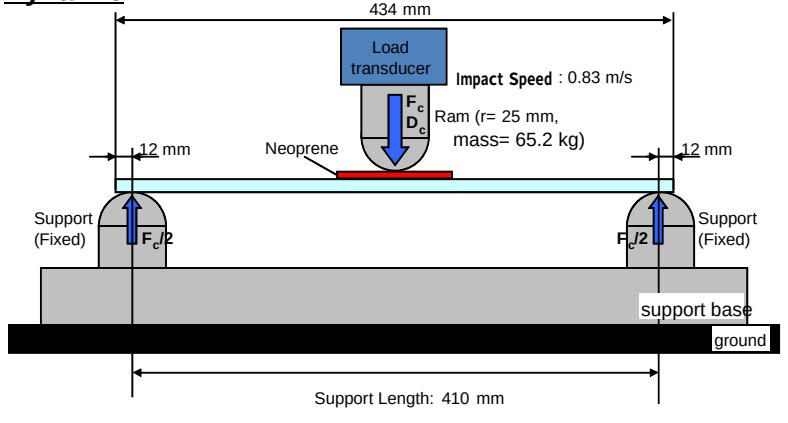


Quasi-static



F_c: Force Center, D_c: Deflection Center
M_c : Moment Center (Nm) = F_c/2 (N) x 0.205 (m)

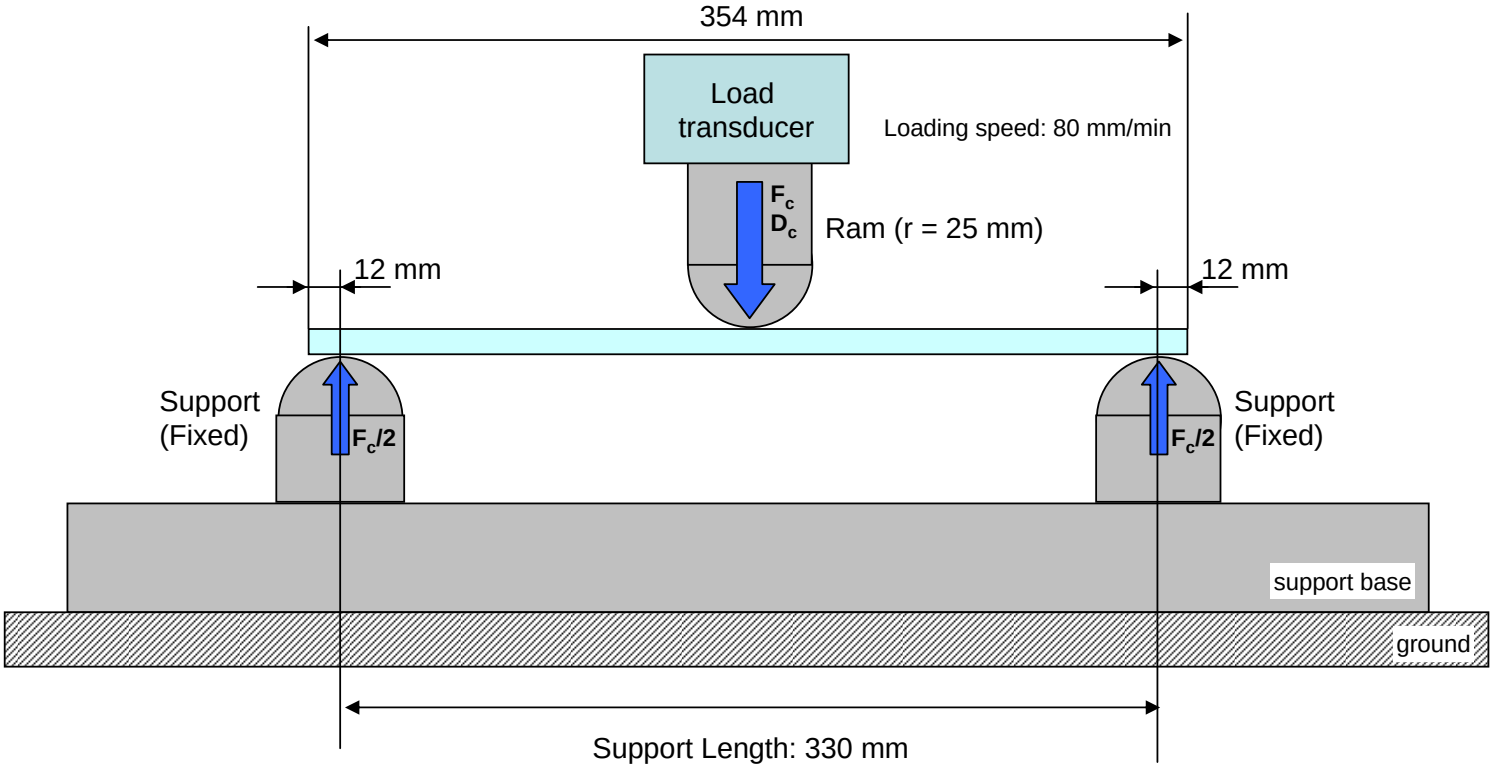
Dynamic



F_c: Force Center, D_c: Deflection Center
M_c : Moment Center (Nm) = F_c/2 (N) x 0.205 (m)

Test Method (for overload test)

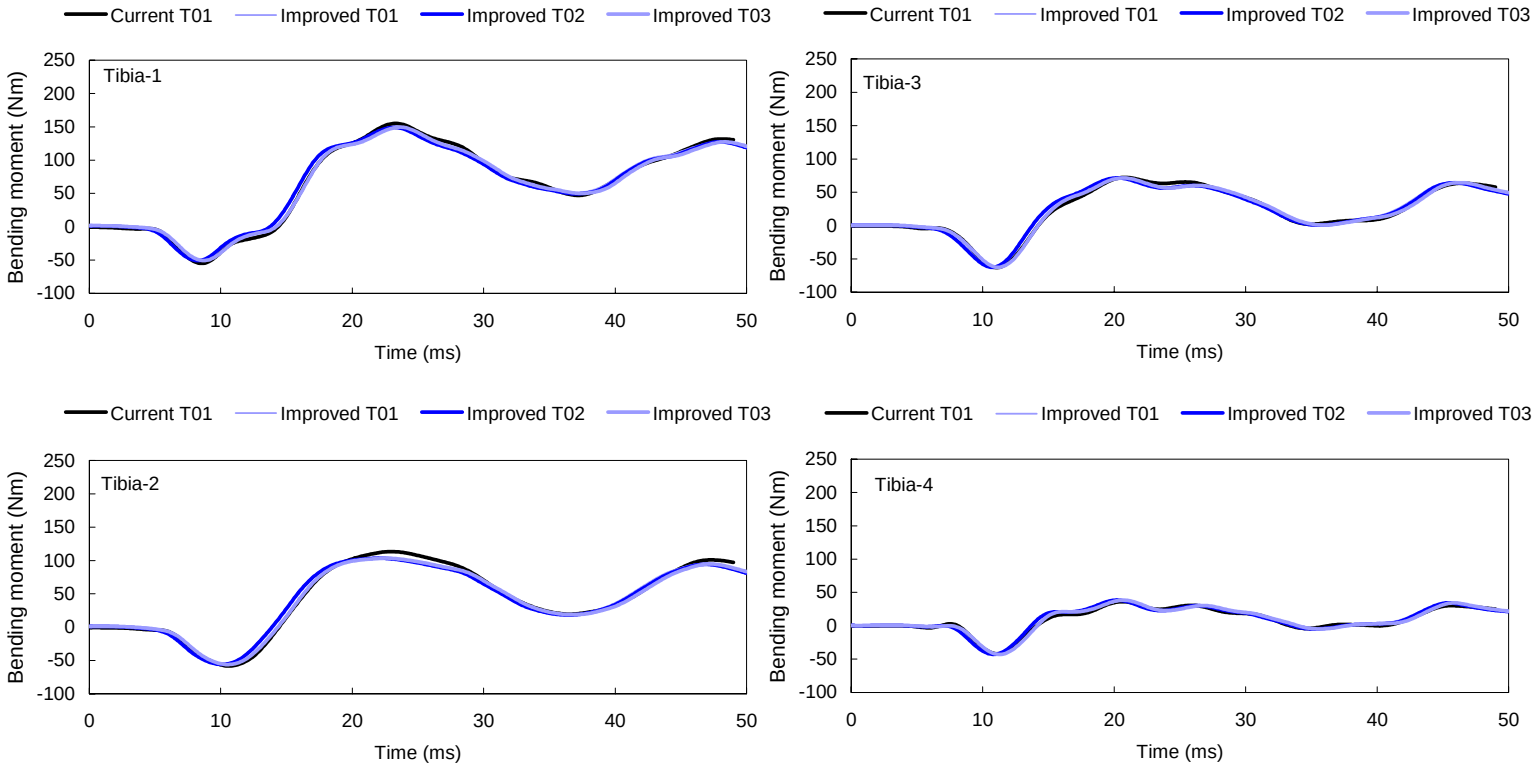
Femur Bone Core
Quasi-static 3-Point Bending Test



F_c: Force Center, D_c: Deflection Center
M_C : Moment Center (Nm) = F_c /2 (N) x 0.165 (m)

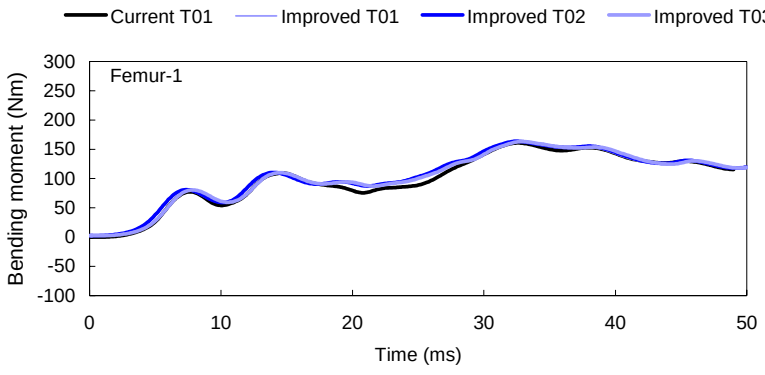
Dynamic Assembly Calibration Test Results (Tibia: Waveform)

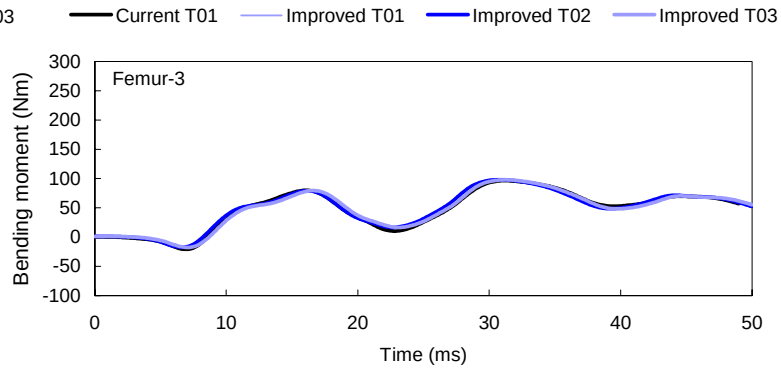
Current and Improved Bone core

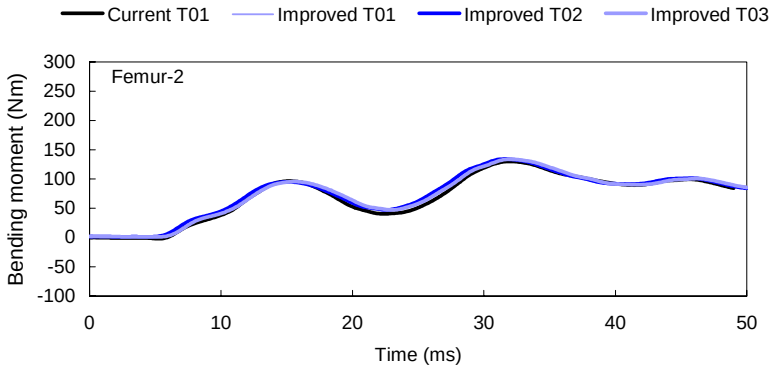


Dynamic Assembly Calibration Test Results (Femur: Waveform)

Current and Improved Bone core

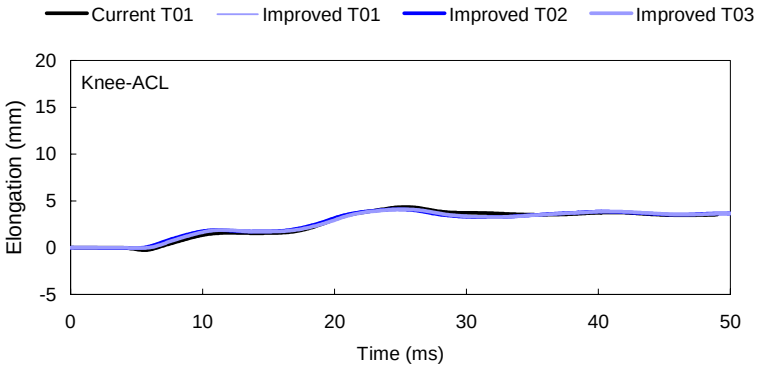


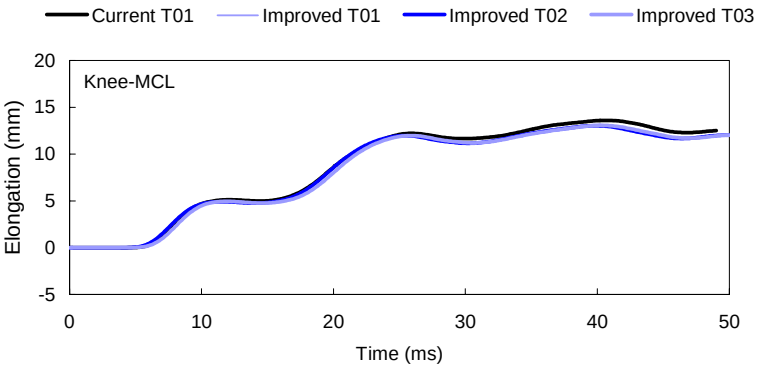


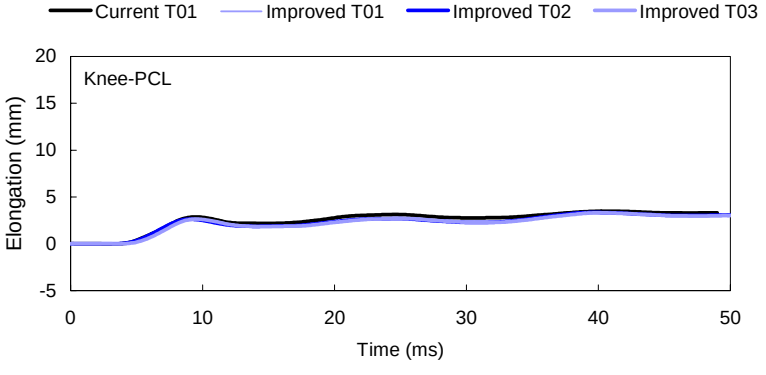


Dynamic Assembly Calibration Test Results (Knee: Waveform)

Current and Improved Bone core



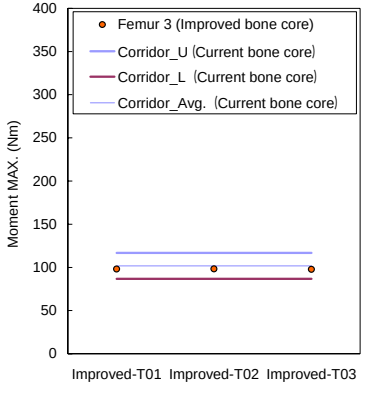




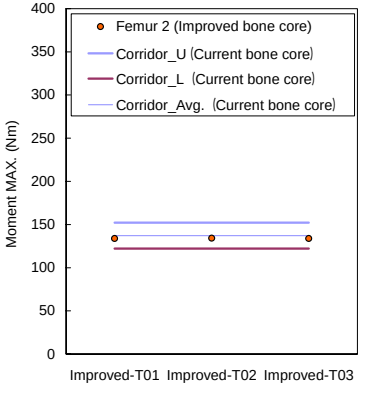
Dynamic Assembly Calibration Test Results (Femur and Tibia: Max. Value)

Improved Bone Core

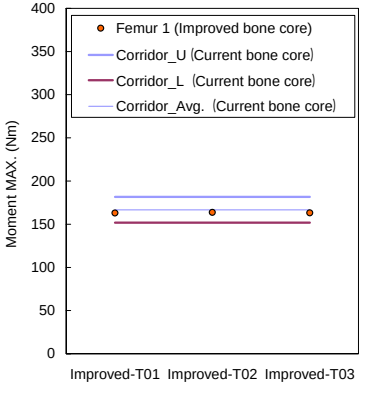
Femur 3



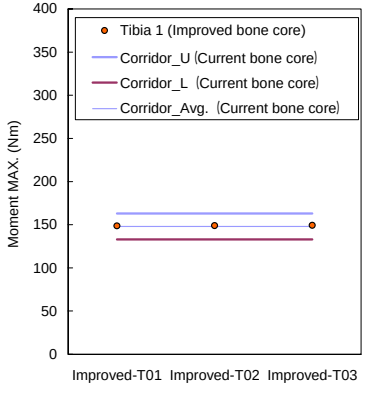
Femur 2



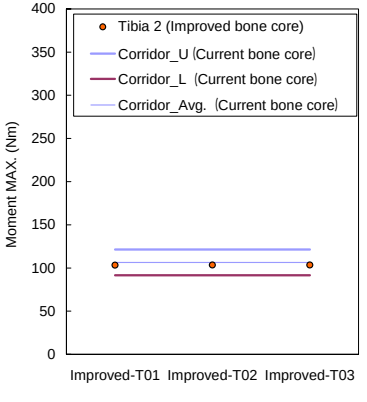
Femur 1



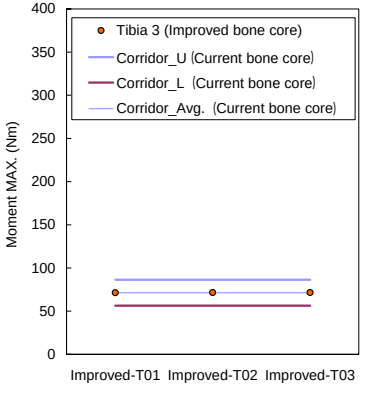
Tibia 1



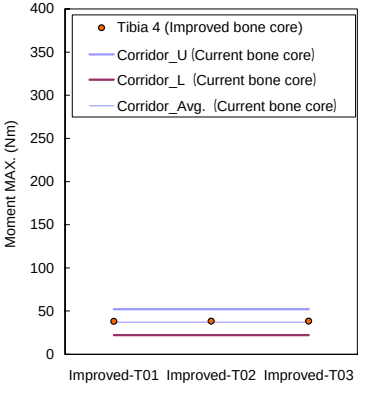
Tibia 2



Tibia 3



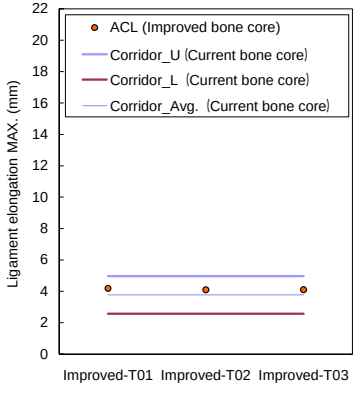
Tibia 4



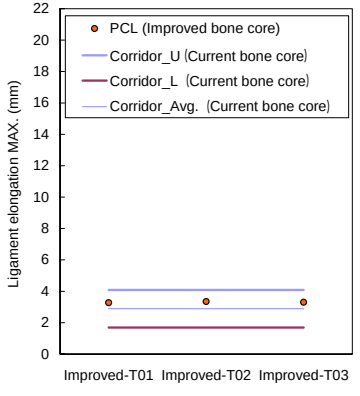
Dynamic Assembly Calibration Test Results (Knee: Max. Value)

Improved Bone Core

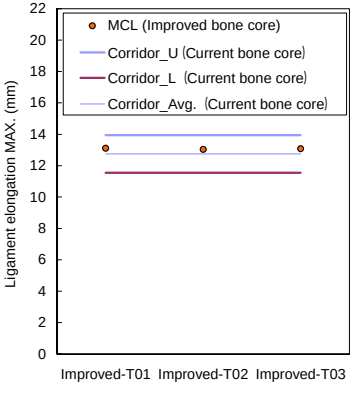
ACL



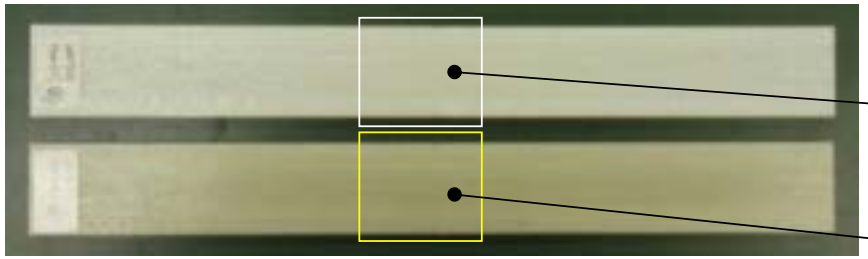
PCL

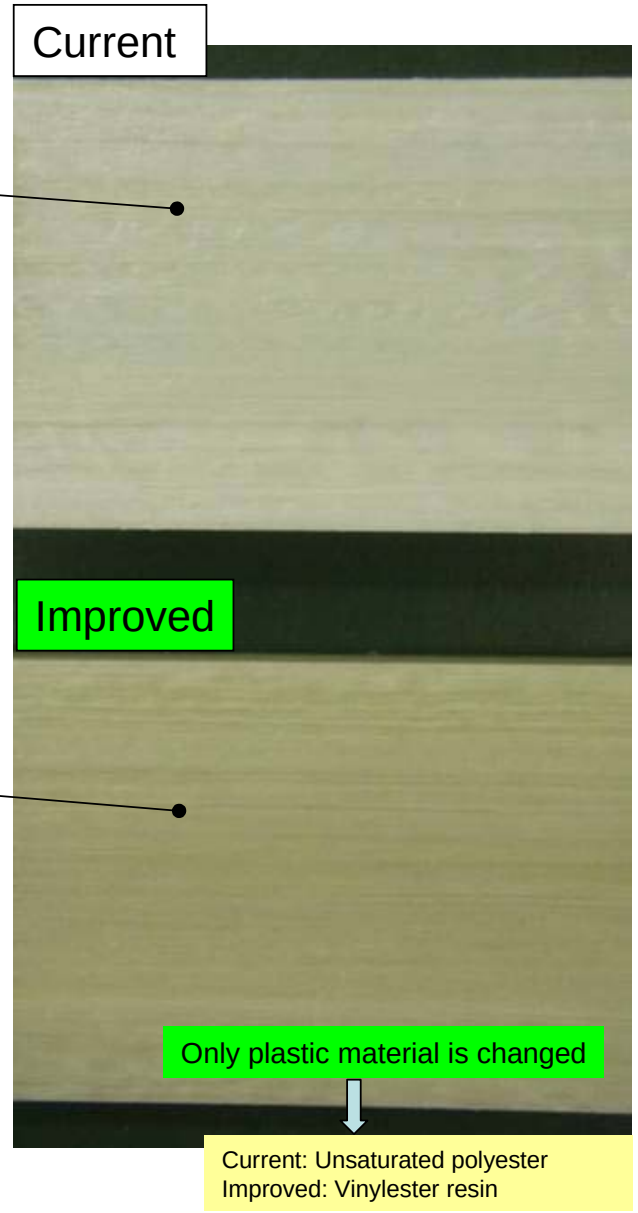


MCL



Improvement of Durability of Bone Core





Conclusions

- **Improved bone core has superior durability** than the current one.
- Improved bone core and current bone core has same bending characteristics under the quasi-static tests, dynamic 3-point bending tests, and dynamic assembly calibration tests, i.e. **both bone cores responses are comparable**.
- JAMA-JARI recommends to use the improved bone cores for the **Flex-GTR-prototype spare parts.**