# **Appendix 1.** Materials and Methods

### **Section 1**

The femur and tibia were resected 32 cm proximally and 28 cm distally from the knee’s joint line respectfully, to allow mounting the cadaveric knee joint simulator. Additionally, each bone is embedded into metal containers with a depth of 10 cm. Allowing for some margin and taking the distance between the pair of bone pins used for each bone, this leaves us with the specified distance for mounting the marker frames.

### **Section 2**

The femoral condyle centers and other anatomical landmarks [4] were a priori determined with a segmentation software (Mimics 20.0, Materialise, Leuven, Belgium) using preoperative CT images and as such their positions were expressed—and assumed constant—with respect to the marker frames allowing to track them during testing.

### **Section 3**

Our method was as closely as possible replicated from the reference paper of Gray et al. [2] Since no detailed information was provided therein in terms of layer thickness or sensor attachment using glue, we optimized the attachment through a series of pilot experiments until convergence, to integrate the reported method in our specific experimental setup. More specifically, we applied two brush strokes of polyurethane until a visible amount of liquid was found to be present on the bone surface. After curing, the layer was visually inspected again. Next, very fine sandpaper was used to remove the layer until we reached the cortex of the tibia, while taking care not to damage the bone surface. The aim of using polyurethane was to fill the bone pores and thus create a flat surface for gauge attachment. We observed that the most accurate way of sand-papering was to remove the thin polyurethane layer until you see just start to see bone dust rising. To sum up, these steps were investigated multiple times by sacrificing some materials and strain gauges before the experiment.

### **Section 4**

As suggested by the manufacturer (Kyowa, Tokyo, Japan), sensors were arranged in a Wheatstone configuration (Supplemental Fig. 1A; supplemental materials are available with the online version of *CORR*®) and attached to RJ50 connectors (Supplemental Fig. 1B; supplemental materials are available with the online version of *CORR*®).

For the three strain gauges (Supplemental Fig. 1C; supplemental materials are available with the online version of *CORR*®) attached to each tibia (anteromedial, anterolateral and posterior), a matching dummy sensor (Supplemental Fig. 1D; supplemental materials are available with the online version of *CORR*®), was also used, as recommended by the manufacturer. These dummy sensors were attached to the matched femoral neck of each specimen and were used to compensate for environmental factors (such as temperature).

### **Section 5**

Scott et al. [3] reported the highest strain occurred between 25 mm to 30 mm from the joint line in their in vitro study. On the other hand, Burr et al. [1] investigated the in vivo strains in human tibiae. They reported the strain gauge position was 20 mm from the joint line. We used a digital caliper (error of ± 0.01 mm) and drew a line from the medial condyle to the distal tibia approximately aligned with tibial axis until we reached 30 mm from the joint line. Then, we positioned the anterior sensors closely to the medial collateral ligament and patellar tendon. However, due to geometrical differences, the positions could not be set with high accuracy. As a result, we recorded those sensor positions using a wand marker frame to capture the sensor position through a motion tracking system. Then, we computed the exact position of each sensor on the tibia using segmentation software (Mimics 20.0). Since each leg has a different geometry, the optimal approach was to normalize the sensor distance with respect to anatomical axes.

**References**

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2. Gray HA, Taddei F, Zavatsky AB, Cristofolini L, Gill HS. Experimental validation of a finite element model of a human cadaveric tibia. *J Biomech Eng*. 2008;130:1-9.
3. Scott CEH, Eaton MJ, Nutton RW, Wade FA, Pankaj P, Evans SL. Proximal tibial strain in medial unicompartmental knee replacements — A biomechanical study of implant design. *Bone Joint J*. 2013; 95:1339-1347.
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**Legends**

**Supplemental Fig.1** Strain gauge set-up.(A)Schematic of Wheatstone configuration, (B) RJ50 cables and strain gauge set-up, (C) main sensors on the anterior tibia and (D) dummy sensors on the preserved femoral neck.