Client Needs

Client Need Statement

Our client is Dr. Corinne Henak, the principal investigator of a lab studying orthopedic biomechanics who need the purpose of eventually delivering real-time knee tissue health information to orthopedic surgeons during a

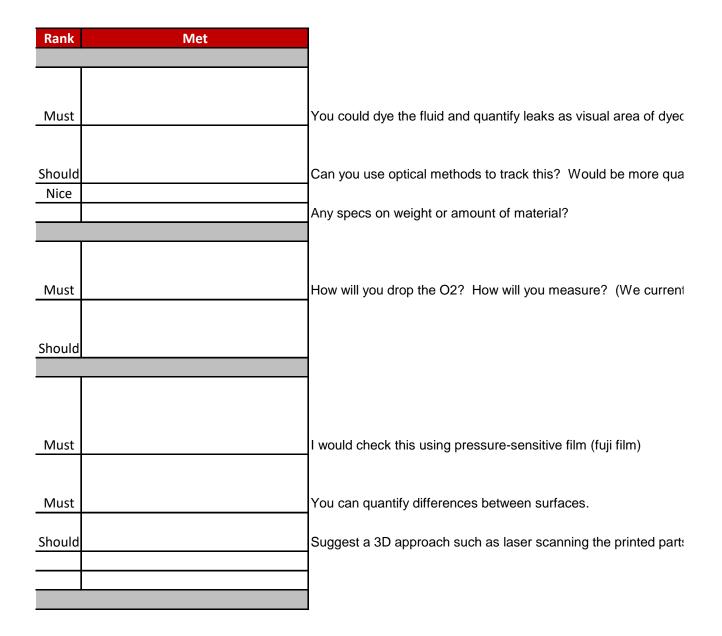
List of client needs (in their words)

The manikin must be anatomicaly correct, spanning from mid-shaft femur to mid-shaft tibia/fibula, to allow for pr The project should be split into divisions: oxygen control systems (PBS), joint system (shape, joint connection), a Hard anatomical elements, like bone, should be 3D printed with a biocompatible material, and soft parts, such a Cartilage from the femoral side should be included, however this is less preferred over including cartilage from t The manikin is intended to be reusable, however reusability is slightly dependent on cost of manufacturing. As patient variability impacts the anatomy of the knee which in turn creates variations in the cartilage properties, Specifically, the proximal tibia and the distal femur will be inserted into the model, along with cartilage/meniscus Mechanical loading of the cartilage is not part of the design, therefore there is no need to recapitulate in vivo joir Inadverdent loading during handling of the cartilage is to be avoided as it can damage the samples

Specification description	Target	Unit	Test method
			Enclosure
PBS/irrigating synovial fluid: Media contained			
within the knee model should remain inside			
and avoid leakage	-	-	Visual inspection
Knee model flexion: the enclosure should			
permit the knee to contract and expand			
according to the procedure	0-150	degrees	Protractor
Reusable			
			Pump
The pump system should maintain the			
oxygen concentration of the media in a			
healthy range for the chondrocytes	2-10	percent	Oxygen monitoring sensor
The pump should maintain a flow pressure			
similar to that which is used in arthroscopic			
knee procedures	40-80	mmHg	Flow meter/orifice plate
	T	T	Joint/Mounting
No mechanical stress should be applied to cartilage inserted to the model which would			Comparison between health of mounted and non-mounted cartilage by measurement of
cause a difference in the health of the tissue	?	?	autofluorescence
The knee joint should be anatomically			
correct to the rough dimensions of an			
average weighted 50 year old	-	-	Visual Inspection
Each joint model should be reproducible			
between fabrication attempts	?	?	Measurement using calipers, tape, etc.

Engineering Specifications

	CRH comments
ds a model to measure cartilage health for	7
arthroscopic procedures.	
	Arthroscopy would fit in here
oper positioning during arthroscopy.	How anatomically correct?
and housing of cartilage / insertion of	
s ligaments should be fabricated out of	Agreeing with Russ's feedback in the meeting - my material sug
he tibial side as femoral cartilage often	
, the model should be able to adapt to	Ideal case includes a range, but narrowing the range would be c
, requiring a placeholder that will serve to	Use anatomical terms to be more clear (proximal tibia, distal fer
nt loading	
	Two pieces here, suggest separating them out: (1) mehcanical I



loading of the cartilage is not a part of the design - i.e., there is no need to recapitulate in vivo joint loading; (2) in

Intitative than holding up a protractor. Also, any requirement for holding a position (not sure if that goes here or u

tly bubble N2 to drop O2, and use a dissolved O2 sensor to measure. Note that dissolved O2 is not the same as

advertent loading during handling is to be avoided as that can damage the samples