INTRODUCTION:
The human tibia is often affected by osteoarthritis or other degenerative diseases. The fact that the knee joint is a weight bearing joint requires pain free function and, should partial or total knee arthroplasty be required, that knee function after surgery is as close as possible to the normal joint.

When resurfacing the tibia, axial and sagittal alignment is achieved with reference to the long axis of the tibia. This is not without problems in cases of previous tibial trauma or skeletal deformity. Alternative approaches to achieving appropriate three-dimensional alignment could include the use of the tibial plateau rim and/or the proximal tibial surface. However, the repeatability of this is uncertain. The objective of the present work was to determine whether or not there is a difference in orientation of a best-fit plane on the tibial plateau when only points on the outer rim are selected as compared to points on the outer rim and on the proximal surface itself.

METHODS:
Magnetic Resonance Image (MRI) scans of healthy adult knees were reconstructed, the bony geometry of the tibia was selected and analyzed in each case, using custom-made computer program. The patients provided informed consent to participate, as approved by the University of Rochester Research Subjects Review Board. The local tibial reference frame was set as previously described by Fitzpatrick [1], with the x-axis in the antero-posterior direction, the y-axis in the medio-lateral direction and the z-axis along the tibial shaft. Twenty to 25 points on the outer rim of the tibial plateau were selected for the ‘Rim Only’ case. For the ‘Rim & Plateau’ case, an additional 12 to 15 points at a distance of 6-7mm towards the middle of the tibial plateau (Figure 1). Using an algorithm developed by Pearson in 1901 [2], a best-fit plane was then constructed through the points. The normal vector of each plane was recorded and the angle of each vector to the z-axis was calculated using simple 3D vector analysis.

DISCUSSION:
The analysis shows that, in anthropometrics of the tibia, it does not make a significant difference in the orientation of a best-fit plane if the points through which the plane is fitted are selected only on the outer rim or on the rim as well as on the proximal surface of the tibia.

Although there is some uncertainty associated with the setting of the coordinate frame, which might account for the range of values in some orientations, this does not mean that the present analysis is not reliable. In fact, all subjects that showed an extreme inclination when only points on the outer rim were taken also had an inclination in the same order when points along the rim as well as on the articular surface were selected.

As shown previously [3], the scan volume can have a considerable influence on the setting of the coordinate frame. This fact might be the reason for the relatively wide range of values in the yz-plane. Hence, it is suggested that the relatively wide range of values is partially due to the variation in setting of the coordinate frame, with scan volume effects being a confounding factor.

In conclusion, should an alternative approach to achieving alignment for tibia resurfacing be desired, this study indicates there is no significant difference between reference planes defined solely from points on the rim of the tibial plateau or points selected on the rim as well as on the surface of the tibial plateau surface. In scenarios where the long-axis of the tibia is compromised, this may be advantageous.

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REFERENCES: