INTRODUCTION:
Achieving proper rotational alignment is one of the important factors to improve clinical results of total knee arthroplasty. Medial edge or medial third the patellar tendon attachment has been recommended, but few studies theoretically supported efficacy of these references. Tibial component should be aligned parallel to the femoral component to avoid rotational mismatch and be implanted at the center of the cut surface in the mediolateral direction to achieve better fixation. Akagi et al proposed the AP axis of the tibia as a line connecting medical edge of the patellar tendon attachment and the middle of the PCL [1]. They reported this line is perpendicular to the surgical epicondylar axis in normal knees. Akagi’s line, however, is not always passing the center of the cut surface. Therefore, this line can be used as rotational landmark, but cannot be used as reference for the mediolateral position. A line perpendicular to the SEA and that is passing center of the cut surface would be more useful for surgeons. This study investigated to find appropriate anatomical references for achieving proper alignment and position of the tibial component using preoperative CT scan.

MATERIALS AND METHODS:
Forty-six osteoarthritic knees with varus deformities were evaluated using CT scans before TKA. We selected a slice level of the proximal tibia 8 mm distal from the lateral tibial plateau. The surgical epicondylar axis (SEA) was defined as a line connecting the most prominent points of the medial and lateral epicondyles of the femur, and a line paralelling the SEA and the longest distance on the proximal tibia was drawn (Line P-SEA). A line was drawn perpendicular to and passed through the midpoint of Line P-SEA, and the location where the line passed at the patellar tendon was investigated (Figure 1). (100 X a/a+b)

Efficacy of two different reference lines was also evaluated. One reference is a line connecting the medial third of the patella tendon and the midpoint of Line P-SEA, and the other is a line between the medial edge of the patellar tendon and the midpoint of Line P-SEA. The angle between one of these reference lines and the perpendicular to the SEA was measured.

RESULTS:
1. Where does the line perpendicular to and passing through the midpoint of Line P-SEA pass at the patellar tendon?
The line perpendicular to and passing through the midpoint of Line P-SEA passed at the 32.2 ± 9.7% of width of the patellar tendon.

2. Where a line between the medial third of the patellar tendon and the midpoint of Line P-SEA is used as reference at the proximal tibia, how much of the rotational mismatch would occur relative to the SEA?
The tibial reference line was externally rotated in 0.2 ± 5.3 degrees relative to the perpendicular to the SEA. When using this reference, rotational mismatch was less than 5 degrees in 32 knees (70.0 %), and less than 10 degrees in 43 knees (93.5 %) (Figure 2).

3. When a line between the medial edge of the patellar tendon and the midpoint of Line P-SEA is used as reference at the proximal tibia, how much of the rotational mismatch would occur relative to the SEA?
The tibial reference line was internally rotated in 18.2 ± 6.2 degrees relative to the perpendicular to the SEA. When using this reference rotational mismatch was less than 5 degrees in one knees, and less than 10 degrees in three knees.

DISCUSSION:
The results of this study showed that the line connecting the midpoint of Line P-SEA passed at approximately medial third of the patellar tendon. The results also showed that more than 90% of the patients would avoid more than 10 degrees of rotational mismatch by using the medial third of the patellar tendon and the midpoint of Line P-SEA as reference. Since the midpoint of Line P-SEA is recognized as a center of the cut surface during surgery, this line is easy to find, and is a reliable reference to minimize rotational mismatch. Many surgeons have used the medial third of the patellar tendon without theoretical background, but this study proved theoretical advantage of this reference in avoiding rotational mismatch.
Akagi’s line (the line connecting between the medial edge of the patellar tendon and the midpoint of the PCL) is also useful rotational reference. Surgeons, however, should be careful to use it because this line cannot always be used for medio-lateral reference for the tibial prosthesis. In addition, after the proximal part of the tibia is cut, the midpoint of the PCL is difficult to find it. In such cases, if we use the line between the medial edge of the patellar tendon and the center of the cut surface, surgeons should know the line is internally rotated in nearly 20 degrees relative to the perpendicular line to the SEA. The current study also showed that using that reference would make more than 10 degrees of rotational mismatch in most of cases. Limitation of this study was that we evaluated rotational mismatch on only preoperative CT scan. However, rotation between the femur and the tibia might change postoperatively. Investigation using postoperative CT scan should be also performed.

REFERENCES: