



Accuracy of Ratio for Center of The Ankle Method as a Landmark for Proximal Tibial Resection in Computer Assisted Total Knee Arthroplasty Compared with Extramedullary Method

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Abstract

Proximal tibial resection is an important surgical step in total knee arthroplasty (TKA). Normally, an anterior surface of tibia used as anatomical landmark (extramedullary method), this method based on visual judgment. (D.C. Marchant, 2005) calculated ratio for center of the ankle, ratio of lateral distance to total inter-malleolar distance was observed at 0.57 in normal ankle sample. However, there is no study documenting about accuracy of ratio for center of the ankle as a landmark for proximal tibial resection in computer assisted TKA (CAS TKA).

This was prospective study on 65 patients with osteoarthritis knees scheduled to receive CAS TKA from January to December 2018. Proximal tibial resection was simulated by extramedullary method and ratio for center of the ankle respectively. Tibial resection alignment were recorded by CAS.

Tibial resection alignment within 3 degrees was 84.6 and 92.3% for extramedullary method and ratio for center of the ankle method. The average total tibial resection alignment was 0.84 and 0.66 degrees of valgus ($p = 0.497$), the average tibial resection alignment within 3 degrees from mechanical axis was 0.33 and 0.55 degrees of valgus ($p = 0.513$) and the average tibial resection alignment more than 3 degrees from mechanical axis was 3.60 and 1.5 degrees of valgus ($p = 0.049$) for extramedullary method and ratio for center of the ankle method respectively.

Ratio for center of the ankle demonstrated result in numeric value and anatomical landmark of lateral and medial malleoli was simple to identified. Our results shown the

tibial resection alignment with ratio for center of the ankle method had higher accuracy and lower average degrees of outlier than extramedullary method.

Introduction

Proximal tibial resection is an important surgical step in total knee arthroplasty (TKA). Normally, an anterior surface of tibia used as anatomical landmark (extramedullary method), this method based on visual judgment. DA Dennis et al.¹ showed 88% of extramedullary method were aligned within 2° of 90° goal versus only 72% of intramedullary method. Bruno et al.² showed the mean alignment of the tibial component was 90.3° (84-97°) with intramedullary method and 88.5° (83-94°) in extramedullary method. Tsukeoka et al.³ they concluded rotational mismatch between the proximal and distal part of the tibia should be avoided and distance between the alignment rod and the bone should be as short as possible to achieve proper tibial alignment. Extramedullary method had a good accurate but some literatures reported many factors might be affect the accuracy of extramedullary method such as preoperative leg's deformity, length and width of the leg, tibial bowing and parallax error.

Tanutum Pikulkaew er al.⁴ reported center of the ankle in THAI subjects were located lateral to the mechanical axis with an average of 2.1 ± 1.1 mm. D.C. Marchant et al.⁵ calculated ratio for center of the ankle, ratio of lateral distance to total inter-malleolar distance was observed at 0.57 in normal ankle sample. Therefore, a thorough understanding of corrected landmark for proximal tibial cutting is critical for successful TKA. The aim of this study was to investigate the accuracy of ratio for center of the ankle as a landmark for proximal tibial resection in computer assisted TKA (CAS TKA).

Materials and Methods

We prospective reviewed 65 patients with osteoarthritis knees undergoing primary CAS TKA (Orthopilot 4.4, B. Braun, Aesculap, Tuttlingen, Germany) from January to December 2018. Proximal tibial resection was simulated by extramedullary method and ratio for center of the ankle method respectively. Tibial resection alignment were recorded by CAS and compared between both methods.

First, we simulated proximal tibial resection with extramedullary method by placed the cutting guide instrument to parallel with anterior 1/3 of tibial crest. Second, we measured intermalleolar distance from the most prominent point at lateral and medial malleolus then marked the point at 57% from lateral malleolus as a landmark for placed the cutting guide instrument onto this area (ratio for center of the ankle method). Information regarding tibial cutting alignment were collected from the navigation data for analysis.

Results

Tibial resection alignment within 3 degrees was 84.6 and 92.3% for extramedullary and ratio for center of the ankle. The average total tibial resection alignment was 0.84 and 0.66 degrees of valgus ($p = 0.497$), the average tibial resection alignment within 3 degrees from mechanical axis was 0.33 and 0.55 degrees of valgus ($p = 0.513$) and the average tibial resection alignment more than 3 degrees from mechanical axis was 3.60 and 1.5 degrees of valgus ($p = 0.049$) for extramedullary method and ratio for center of the ankle method respectively.

Discussions

Although extramedullary method had a good accuracy but some literatures reported many factors might be affect the accuracy of extramedullary method. Ratio for center of the ankle demonstrated result in numeric value and anatomical landmark of lateral and medial malleoli was simple to identified. Our results shown the tibial resection alignment with ratio for center of the ankle method had higher accuracy and lower average degrees of outlier than extramedullary method. This landmark guided the surgeons know the true center of the ankle easier than visual judgement with extramedullary method. We concluded, ratio for center of the ankle is one of accurate, reproducible and reliable anatomy landmark for proximal tibial resection in TKA.



Intermalleolar distance
(100%)



Marked point at 57% from
lateral malleolus



Placed the instrument on
marking area

Figure 1: Ratio for center of the ankle method

	Percent of tibial resection within 3° from mechanical axis
Extramedullary Method	84.6 %
Ratio for center of the ankle Method	92.3 %

Table 1: Results in tibial resection alignment

	Extramedullary Method	Ratio for center of the ankle Method	P-value
Average total tibial resection alignment	0.84° valgus	0.66° valgus	0.497
Average tibial resection alignment within 3° from mechanical axis	0.33° valgus	0.55° valgus	0.513
Average tibial resection alignment > 3° from mechanical axis	3.60° valgus	1.50° valgus	0.049

Table 2: Sub-analysis in tibial resection alignment

References

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