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## Research paper

# Evaluation of anatomical knee joint line restoration in revision total knee replacement patients and its functional outcome: A retrospective cohort study

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## ABSTRACT

Evaluation and correct reposition of joint line is ultimate challenge for arthroplasty surgeon during revision total knee replacement. Majority of landmarks had already destroyed while removing bone for either septic/aseptic loosening or for infection. This leads to poor outcome and post-operative dissatisfaction. There are various methods have been described but none is reliable. We are describing a method to evaluate joint line pre operatively and possible application intraoperatively. The medial and lateral epicondyle are easily identifiable landmark in radiograph as well as intraoperatively. We used Tran's epicondyle axial width (TEAW) method for the evaluation of joint line in AP view and Figgie's method for evaluation of joint line in lateral view. Patella position was diagnosed with Caton deschamps index. These measurements were tested for intra- and inter-observer differences. Then, the relationship between these two measurements was studied. All patients were called back for reevaluation and recording knee society score. The mean duration of follow up was 5.8 months. The mean Knee society score was 73.8 in preoperative period which increased up to 89 in postoperative period. The 3 patients in whom joint line was elevated more than 5 mm from native joint line shows less improvement in knee society score by 7 points compare to others. The difference of which is statistically significant with p value 0.0004 when measured by unpaired T test. Once the TEAW was determined preoperatively, the joint line level is found during surgery by using a caliper This method leads to better pre-operative idea of joint line and can be reproduced intraoperatively and can leads to a reduced risk of re-intervention following revision total knee arthroplasty.

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## 1. Introduction

Geometry, orientation and position of the tibio femoral joint interface determine knee function. This is intimately related to knee kinematics, kinetics and stability.

There are various reasons for surgeon to raise the joint line in revision Total Knee Arthroplasty like distal femoral bone loss, posterior femoral bone loss and larger flexion space in revision cases. When this bone loss is not compensated by augmentation on

the femoral side, a thicker polyethylene insert will be required to obtain adequate ligament balance and an elevated joint line will be the result.<sup>1</sup> More than in primary TKA, joint line restoration is a well-known problem in revision TKA. Elevation of the joint line alters the flexion-extension axis which can subsequently lead to laxity of the posterior capsule, PCL and collateral ligaments at midflexion range i.e., 30–60 and thereby contribute to midflexion instability. Near anatomical restoration of joint line is critical to minimize the risk of mid-flexion instability, a reduction in range of motion, impingement of the patellar tendon against the tibial tray and gap imbalance. Use of anatomical landmarks around knee is widely studied for evaluation of joint line.

A number of landmarks can be used intraoperatively like a point 1.5 cm cranial to the fibular head, 2 cm cranial to the tibial

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Fig. 1. Medial and lateral epicondyle to joint line distance.

tuberosity.<sup>2</sup> Usually the normal joint line was reported to be approximately 25 mm caudal to the medial femoral epicondyle, 23 mm caudal to lateral femoral condyle and it has constant relation with trans epicondylar axial width (TEAW).<sup>3</sup>

The creation of a relative patella baja is another consequence of joint line elevation, especially in revision TKR. Mechanical impingement of the low riding patella against the tibia insert will cause pain and limited knee flexion.<sup>4</sup> This lower patella position can be measured by Caton deschamps index relative to the joint line<sup>5</sup> in lateral knee radiograph (Figs. 1–3).

In 1986, Figgie first identified three major parameters affecting the clinical result after TKA. The position of the joint line was one of them. He stated that a change in joint line of less than 8 mm will result in good outcome. Greater changes were associated with an inferior clinical result.<sup>6</sup>

Porteous et al.<sup>7</sup> reported on 114 revision TKA's. The height of the joint line before and after revision total knee replacement was measured and classified as either restored to within 5 mm of the preoperative height or elevated if it was positioned more than 5 mm above the preoperative height. The joint line was elevated in 41 knees (36%) and restored in 73 (64%). They recommended the greater use of distal femoral augments to help to achieve this goal. They concluded that patients with joint line elevation less than 5 mm has better clinical outcome compare to those whose joint line elevated more than 5 mm.

Romero et al.<sup>8</sup> then develop a constant method to evaluate joint line restoration transepicondylar axial width method (TEAW)



Fig. 2. Figgys method for joint line evaluation in lateral x ray knee joint.



Fig. 3. Caton deschamps index.

which can be applicable to revision total knee replacement patients. Griffin et al.<sup>9</sup> used an MRI technique to quantify a correlation between the Trans epicondylar axial width (TEAW) and the distance to the joint line. They found a nongender-specific linear correlation between the TEAW and the perpendicular distance to the joint line of 0.36 for the medial side and of 0.31 for the lateral side. We have taken griffins method for more accurate evaluation of radiographs for joint line evaluation in our study.

In addition, Periera<sup>10</sup> and Iacono et al.<sup>11</sup> emphasized use of adductor tubercle, medial and lateral epicondyle for evaluation of joint line restoration. However all this study includes normal knees for joint line evaluation.

So in this study we try to reproduce the TEAW method for accurate evaluation of joint line in revision TKR patients. With this method, we mainly use distal femoral augments to ensure the anatomical joint line restoration. We can further verify if our TEAW method is suitable for preoperative planning and its intraoperative application (Table 1).

### 1.1. Overview

This study is a retrospective study of radiological evaluation in post-revision TKR patients of 6 month duration and to evaluate their functional outcome done at sunshine hospital, secundarabad, Telangana.

### 1.2. Aim

To provide clinical evidence for TEAW method for its application in evaluation of joint line in revision TKR patients and functional outcome related to it.

### 1.3. Objectives

1. To evaluate accurate restoration of joint line in patients who underwent revision total knee replacement and it's functional outcome

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