ORIGINAL ARTICLE

Association of sagittal alignment of tibial and femoral components with clinical outcome in total knee arthroplasty

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Introduction: Total knee arthroplasty (TKA) is one of the most commonly performed surgeries for osteoarthritis of knees. It was documented that a flexed femoral component causes loosening of tibial component by impingement of femoral cam on tibial post. A femoral component in extension will lead to decreased flexion, notching of anterior cortex, osteolysis and may cause supracondylar fracture. We conducted this study to evaluate the sagittal alignment of components of TKA by standard technique and its effect on short-term clinical outcome. **Materials and Methods:** A prospective and observational study on 52 patients posted for primary TKA. Sagittal femoral and tibial angles were measured from post-operative lateral radiograph at 2nd week. American knee society scoring system (AKSS), Oxford knee society scoring system, visual analog scale (VAS) were recorded preoperatively, postoperatively at 2nd week and at 3rd month. **Results:** We found that in terms of sagittal femoral alignment, we noticed best short-term clinical outcome in group that had femoral component in 0–5° of extention (FA 91–95°) in comparison to group that had femoral component in flexion (FA 86–90). **Conclusion:** We can conclude that there is positive association between proper sagittal alignment of femoral and tibial components in TKA with clinical outcome and the clinical outcome (in terms of mean AKSS) is better when femoral component is placed in extension and when posterior tibial slope of <5° is achieved.

KEY WORDS: American knee society scoring system, femoral angle, osteoarthritis, oxford knee society scoring system, tibial angle, total knee arthroplasty, total knee replacement

INTRODUCTION

With increasing life expectancy, incidence and prevalence of osteoarthritis (OA) of knees have increased.[1] Total knee arthroplasty (TKA) is one of the most commonly performed surgeries for OA of knees with the aim of TKA is to reduce joint pain and maintain fair range of motion (ROM) to facilitate the ability to perform day to day functional activities.[2,3]

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Correct alignment of components in coronal, sagittal, and axial plane is desirable for optimum clinical outcome, patient satisfaction, and longevity of procedure.[4]

It was previously believed that sagittal orientation of components has minimal effect on ROM and implant survival. Later, it was documented that a flexed femoral component causes loosening of tibial component by impingement of femoral cam on tibial post.[5] A femoral component in extension will lead to decreased flexion, notching of anterior cortex, osteolysis, and may cause supracondylar fracture.[6]

The accepted sagittal alignment of tibial component is 0–7° flexion. Any outlier tibial component will have suboptimal survivorship and clinical outcome.[7] We conducted this study to evaluate the sagittal alignment of components of TKA by standard technique and its effect on short-term clinical outcome.

MATERIALS AND METHODS

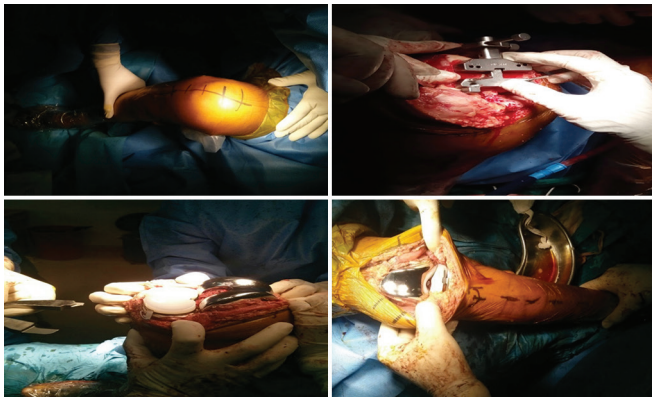
We conducted a prospective and observational study on patients posted for primary TKA, who were willing to participate in the study were enrolled. Demography, detailed clinical information, and informed written consent of the patient were taken. Functional assessment was done using American knee society score.

Patients with primary or secondary OA (Stage III and Stage IV), inflammatory arthritis of either sex, and age 50 years and above were included in the study. Our exclusion criteria consisted of patients with-severe deformity of knee (30° or more deformity), neurovascular diseases, any systemic or local contraindications for surgery, posted for revision total knee replacement, morbid obesity, who had undergone prior osteotomy involving knee joint. Pre-operative ROM of the knee was assessed using standard clinical goniometers. Pre-operative American knee society scoring system (AKSS), Oxford knee society scoring system (OKS) and visual analogue scale (VAS) scores were noted.

A radiographic assessment was done by taking the following X-rays:

Radiograph of bilateral knee in standing position Radiograph of knee in true lateral view in 100% magnification.

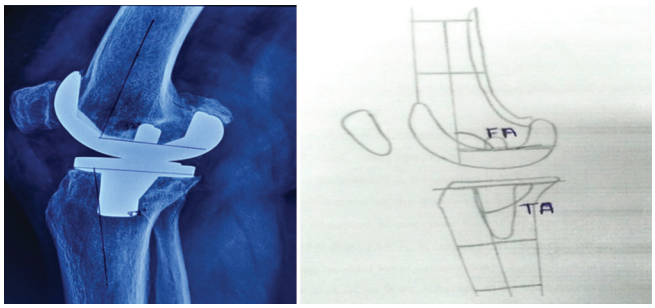
The patient was made to lie in supine position on the operating table after giving appropriate anesthesia and knee post in place. Knees were kept free for intraoperative manipulation. Tourniquet was applied high up over the thigh. After surgical preparation and sterile draping, 15 cm midline longitudinal incision was given over the anterior aspect of the knee extending from a point 5 cm above the superior pole of the patella and proceeding distally to a point just medial to the tibial tuberosity. After resecting the subcutaneous tissues along the line of the incision, the joint cavity was opened by the medial parapatellar approach. The knee was then extended, to evert out the patella, followed by knee flexion. Tibial, femoral, and patellar osteophytes were removed with nibbler. The menisci and ACL were resected. This was followed by distal femoral and proximal tibial cuts using cutting blocks and jigs of appropriate sizes. Following the implantation of femoral and tibial components, that is, CR knee design or CS knee design, closure of the surgical incision was done in layers after inserting the drain. Sterile dressing was applied.



Patient follow-up was done at 2 weeks and 3 months after the surgery. Postoperatively lateral radiograph with marked anatomical axis of both femur and tibia was done at 2nd week at the time of suture removal.

The measurement of femoral and tibial TKA component placement in sagittal plane with respect to femoral and tibial anatomical axes, respectively, was done by method of knee society TKA radiographic evaluation. Alignment of femoral component was measured as the angle (FA) between the line across the bottom of the femoral implant and the femoral shaft mechanical axis. FA = 90° corresponds to neutral placement, FA >90° corresponds to femoral component in extension and FA <90° corresponds to femoral component in flexion.

The tibial component alignment was measured as the angle (TA) between the line across the bottom of tibial plate and the tibial shaft mechanical axis. TA >90° corresponds to anterior tibial slope and TA ≤90° corresponds to posterior tibial slope.

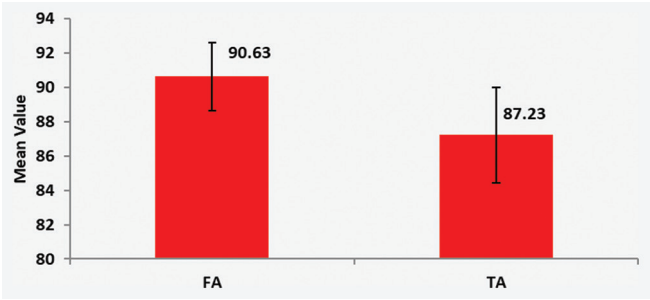


Functional assessment was done using American knee society score, oxford knee scores, VAS at 2nd week and 3rd month. Time taken for straight leg raising in number of days was observed.

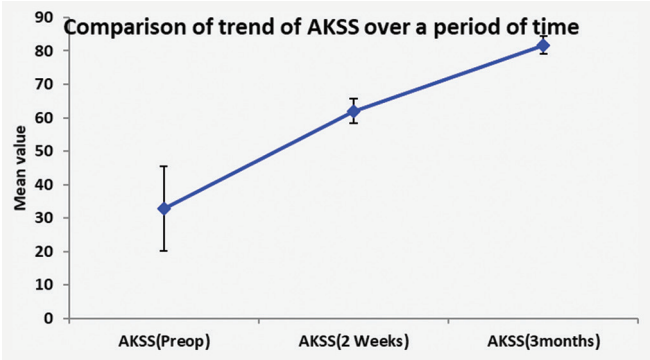
RESULTS

Sagittal femoral and tibial angles were measured from post-operative lateral radiograph at 2nd week. AKSS, OKS, and VAS were recorded preoperatively, at 2nd week and at 3rd month.

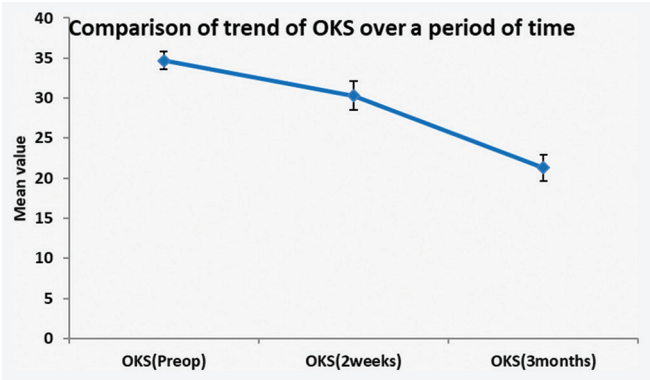
We found the mean femoral angle of the patients considered under my study is 90.63 ± 1.97 with minimum angle being 86° and the maximum angle being 95°. Similarly, mean tibial angle of the patients considered under my study was 87.23 ± 2.78 with minimum angle being 82° and maximum angle being 95°.



The mean AKSS score preoperatively was 32.91 ± 12.61. During follow-up at 2nd week, the mean AKSS score was 61.93 ± 3.66 with *P* value being highly significant, that is, <0.01. At the follow-up of 3rd month, the mean AKSS score was 81.70 ± 2.72 with *P* value being highly significant, that is, <0.01.



The mean OKS score preoperatively was 34.69 ± 1.07. During follow-up at 2nd week, the mean OKS score was 30.30 ± 1.78 with *P* value being highly significant, that is, <0.01. At the follow-up of 3rd month, the mean OKS score was 21.31 ± 1.62 with *P*-value being highly significant, that is, <0.01.



DISCUSSION

In this study, in terms of sagittal femoral alignment, we noticed best short-term clinical outcome in group that had femoral component in 0–5° of extention (FA 91–95°) in comparison to group that had femoral component in flexion (FA 86–90). The subjective as well as objective improvement was significantly better in Group A of femoral alignment. The result obtained was in concurrence with other reported studies. In long-term study, Kim *et al*.[7] reported a higher failure rate of knees with femoral implant aligned in flexion than in neutral or extention.

It was documented in literature that flexion angle of distal femoral cut (that decides flexion angle of femoral component) more than 3.5° is an independent risk factor for clinically detectable flexion contracture of knee, which is subpar clinical result.[8] In contrast a RCT consisting of FA of 4° flexion and 0°. Murphy *et al*. recorded no difference in clinical outcome at 1 year and better flexion in flexion group but this study was again a short-term study that cannot document implant survivorship.

In this study, the group with tibial component in posterior tibial slope within 5° (TA = 86–90°) had significantly better clinical outcome than group with TA more than 90 or <86. This finding is in accordance with current literature. The anatomical tibial slope is variable and known to be within 0–7°. It is well documented that recreation of anatomical tibial slope improves the maximum flexion following TKR.[9]

Although clinical outcome after TKR is dependent on many factors such as weight, pre-existing medical condition, pre-operative ROM, magnitude of deformity, and pre-operative instability but alignment of component is probably most important controllable factor.

For successful clinical outcome, the goal is to align both components in neutral position. If one component is mal aligned and other component is placed such as to compensate so that there is combined neutrality, there is increased risk of failure.[4,6]

CONCLUSION

TKA is a definitive procedure performed to relieve pain and to improve the ROM in patients with Severe OA.[2,3] Studies show that with proper alignment of femoral and tibial components in TKA, there is highly significant improvement in mean AKSS, mean OKS and mean VAS score and hence the clinical outcome.[10-14] Thus, we can conclude that there is positive association between proper sagittal alignment of femoral and tibial components in TKA with clinical outcome and the clinical outcome (in terms of mean AKSS) is better when femoral component is placed in extension and when posterior tibial slope of <5° is achieved.

ACKNOWLEDGMENTS

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