CORRELATION REALIGNMENT MECHANICAL TIBIOFEMORAL ANGLE WITH CLINICAL OUTCOME ON PATIENTS KNEE OSTEOARTHRITIS VALGUS DEFORMITY PERFOREMED TOTAL KNEE ARTHROPLASTY

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ABSTRACT

Knee osteoarthritis (OA) are the most important because of the high prevalence of pain and disability in older adults. Angular deformities around the knee joint necessitate special consideration to restore normal alignment during TKA. In the region of 10–15% of patients requiring a primary TKA present with a valgus deformity (VD), the accurate correction of which still poses a challenge. In Ranawat grade-III the axis deviation is more than 20°. The aim of this research to savy correlation realignment mechanical tibiofemoral angle with clinical outcome on patients knee osteoarthritis valgus deformity performed TKA with non-constrained imlpant. This research is an analytics observational with cross sectional that group patients knee osteoarthritis valgus deformity underwent total knee arthroplasty and performed correlation realignment tibiofemoral angle as well as clinical outome with total sampling method on patients knee osteoarthritis valgus deformity Kellgren Lawrence grade III–IV, have radiological knee x-ray and lower extremity scanogram underwent TKA one side by orthopaedic surgeon sub adult reconstruction. Evaluation has performed to pain scale used Visual Analog Scale (VAS) score, clinical outcome with Knee Society Score (KSS), realigment mechanical tibiofemoral angle before and after TKA. Data were analyzed using t-test and correlation test with SPSS version 16. The result with analyzed 28 (male 6, female 22) patients with a mean age 65,75 years, which divided into three group Ranawat grade I was 14 patients, grade II was 9 patients and III was 5 patients. They were evaluated for VAS score, KSS objective and functional, mechanical tibiofemoral angle have significant result (P < 0,05). There was also significantly correlation between improvement mechanical tibiofemoral angle with KSS knee score based value (P < 0,05). In this study we found that TKA with non-constrained implant on knee osteoarthrits valgus deformity provides significant result in reducing pain scale and increased clinical outome.

Keywords: Knee osteoarthritis valgus deformity, Total Knee Arthroplasty, Knee Society Score, VAS Score, mechanical tibiofemoral angle.

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INTRODUCTION

Osteoarthritis (OA) is by far the most common form of joint disease throughout the world. It is strongly associated with age, and extremely common in older people; some studies estimate that over 80% of people over 55 years of age have osteoarthritis of at least one joint. Hip and knee OA are the most important because of the high prevalence of pain and disability that they cause in older adults, and the massive healthcare resource input that results from this, particularly in terms of the provision of joint replacements.

Angular deformities around the knee joint (1) necessitate special consideration to restore normal alignment during total knee arthroplasty (TKA). In the region of 10–15% of patients requiring a primary TKA present with a valgus deformity (VD), the accurate correction of which still poses a challenge. Excessive pre operative malalignment predisposes to a greater risk of failure compared to well-aligned knees (2)(3). Approximately 10% of patients requiring (4) total knee arthroplasty have a valgus deformity (defined as an anatomic valgus of >10°). Correction of the valgus deformity has posed technical challenges and has produced variable clinical results in terms of correction of the deformity, instability, and the overall results.

The valgus deformity in osteoarthritis knee (5) is a continuing process developed by bone tissue remodeling and soft tissue contraction/elongation. Bone tissue alterations consist of lateral cartilage erosion, lateral condylar hypoplasia, and metaphyseal femur and tibial plateau remodeling. Soft tissue alterations are characterized by tightening of lateral structures such as Lateral Collateral Ligament (LCL), Posterolateral Capsule (PLC), Popliteus Tendon (POP), hamstring tendons, the Lateral Head Of The Gastrocnemius (LHG) and Iliotibial Band (ITB) (5,6). In Ranawat grade III the axis deviation is greater than 20°. All stabilizing elements, especially the medial section does not function, implant constrained is needed (2,3).

The purpose of this research to savvy correlation realignment mechanical tibiofemoral angle with clinical outcome on patients knee osteoarthritis valgus deformity performed TKA with non-constrained imlpant. Based on hypothesis there is difference between the VAS (Visual Analog Score) patients pre operative and postoperative TKA, difference between the MTFA (Mechanical Tibiofemoral Angle) patients pre operative and postoperative TKA, correlation between improvement MTFA with improvement KSS pre operative and postoperative TKA.

MATERIAL AND METHODS

This research is analytics observational with cross sectional that group patients knee osteoarthritis valgus deformity underwent total knee arthroplasty and performed correlation realignment tibiofemoral angle as well as clinical outcome with KSS. Data were collected from the patient data bank in the sub adult reconstruction department which is synchronized with the patient's medical

record data at Prof. Dr. R. Soeharso Surakarta Orthopedic Hospital.

This research with total sampling method with criteria inclusion patients knee osteoarthritis valgus deformity Kellgren-Lawrence grade III–IV, have radiological knee x-ray and lower extremity scanogram underwent TKA one side by orthopedic surgeon sub adult reconstruction at Prof. Dr. R. Soeharso orthopedic hospital Surakarta on period January 2019 until December 2019. All surgeries were performed by 4 senior orthopedic surgeons who were adult reconstruction specialists. Exclusion criteria were performed, patients with total revision of knee arthroplasty, patients who had deformity abnormalities in the lower extremities, patients died, patients refused to be used as study samples.

Evaluation has been performed to pain scale used Visual Analog Scale (VAS) score, clinical outcome with Knee Society Score (KSS), realignment mechanical tibiofemoral angle before and after TKA. Data analysis of the research using normalitas test with Kolmogorov-Smirnov test. Data were analyzed using t-test and correlation test with SPSS version 16.

RESULTS

All patients with osteoarthritis of the knee valgus deformity who underwent total knee arthroplasty surgery according to exclusion criteria, there were 4 patients to follow-up loss, 2 patients did not have scanogram data (1 patients of inadequate scanogram and 1 patient had an infection and did not

stand properly). The total inclusion criteria were 28 patients.

This study population consist of 22 women (78.6%) and 6 man (21.4%). The mean age patient was 65 years (range 46 – 77 years), whereas the mean BMI 26.07 kg/m^2 (range, 20.03 – 36.68 kg/m^2). Side operation consists of right side 21 (75%) and left side 7 (25%). Mean data of post operative evaluation was 4.7 months (2 – 10 months) (Tabel 1).

Ranawat grade distribution consists of grade I was 14 (50%), grade II was 9 (32.1%) and grade III was 5 (17.9%). The mean pre operative knee joint ROM was 105.18° (range, 90° – 115°), post operative knee joint ROM was 106.25° (range, 70°-130°). Based on the Ranawat Grade, in Ranawat Grade I, post operative knee joint ROM was 108.9° (range, 80° – 130°); in Ranawat Grade II, post operative knee joint ROM was 96.5° (range, 70° – 120°); whereas in Ranawat Grade III, post operative knee joint ROM was 118° (range, 115° – 120°).

Tabel 1. Pre operative demographic of the patient

Sex (Male/Female)	6/22
Age (y)	65 (46 – 77)
Body mass index (Kg/mm2)	26.07 (20.03 – 36.68)
Normal	15 (50%)
Mild Obese	6 (21%)
Obese	8 (29%)
Range of motion	105.18° (90°-115°)
MTFA	11.35° (1° – 27°)
Operation side (right/left)	21/7
Follow up (months)	4.7 (2 -10)
Ranawat grade	28
Grade I	14 (50%)
Grade II	9 (32.1%)
Grade III	5 (17.9%)

Clinical and Radiological Outcome

The mean VAS score pre operative was 6.39 (range, 5 – 7), whereas the mean post operative was 1.42 (range, 1-3). KSS (Knee Society Score) consists of KSS knee score pre operative was 28 poor (100%), and post operative with criteria 1 fair (3.5%), 8 good (28.5%), 19 excellent (67.8%). KSS function score pre operative was 28 poor (100%), and post operative with criteria 1 poor (3,5%), 2 fair (7.1%), 20 good (71.4), 5 excellent (17.8%).

The VAS score, MTFA, and KSS post operative score were significantly improved at evaluation compared pre operative baseline value ($p < 0,05$). However, for ROM knee joint post operative has no significantly improved compared post operative baseline value ($p < 0,05$) (Tabel 2).

Tabel 2. Comparison of mean pre operative and post operative clinical and radiological result

	Pre Operative	Post Operative	P-Value
VAS Score	6.39	1.42	P < 0.05
ROM knee joint	104.46	106.25	P < 0.05
MTFA	11.35	-0.87	P < 0.05
KSS Score			
KSS knee score	44.17	81.14	P < 0.05
KSS Function score	31.78	70.17	P < 0.05

There is no significant comparison between Ranawat grade 1 and 2/3 with KSS knee score as well as KSS function score baseline value ($p > 0,05$). There is significantly correlation between improvement MTFA with improvement KSS knee score osteoarthritis valgus deformity pre operative and postoperative baseline value ($p < 0,05$) (Figure 1). There is no correlation between improvement MTFA with improvement KSS function score osteoarthritis valgus deformity pre operative and postoperative baseline value ($p > 0,05$). Data after operation experienced under correction of MTFA was 14 patient (50%) with mean 2.78° valgus, neutral correction was 1 patient (3.5%) and over correction was 13 (46.5%) with mean 3.61° varus (Tabel 3). There are results post operative correction MTFA based grade Ranawat. Valgus correction Ranawat grade I (5), II (5), III (4). Varus correction Ranawat grade I (8), II (4), III (1) (Tabel 4). There is no difference between realignment of knee osteoarthritis valgus deformity that become valgus and varus with KSS post operative baseline value ($p > 0,05$).
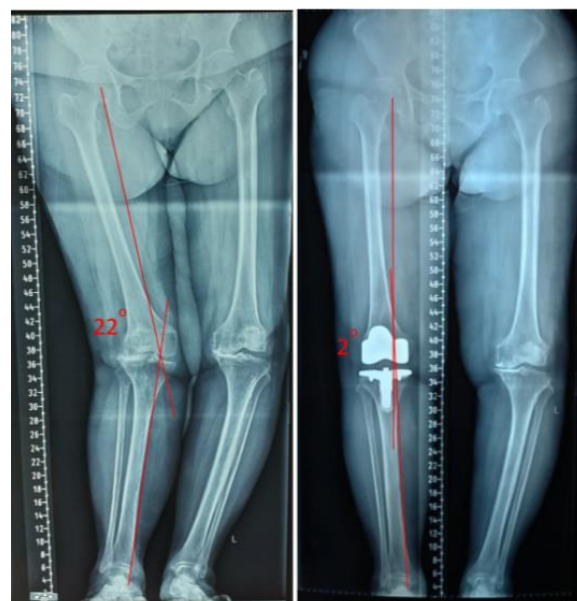

Figure 1. Measurement of MTFA pre operative (22° Valgus) and post operative (2°) realignment correction of knee OA valgus deformity on lower extremity scanogram.

Tabel 3. Result post correction MTFA

Pre operative Valgus	Post Operative		
	Valgus	Neutral	Varus
28 (100%)	14 (50%)	1 (3.5%)	13 (46.5%)

Tabel 4. Result post operative correction MTFA based grade Ranawat

Pre operative Ranawat	Post operative correction	
	Valgus	Varus
Grade I	5	8
Grade II	5	4
Grade III	4	1

DISCUSSION

In the study for the average age of patients around 65.75 years. Based on research conducted by Van Schoor et al, found that people aged 65-85 years have a 1.5 times higher risk of developing OA than other ages. De Zwart, et al also found the risk of a decrease in muscle strength in old age as predictive factors for the occurrence of OA (7). From the data it was found that normal (8) body mass index 14 (50%), mild obesity 6 (21%) severe obesity 8 (29%). Based on research conducted by Kumar et al, it was found that the obese population tends to experience OA by 33% compared to others. This percentage will increase according to the increase in BMI (9). Burn et al in his study also found that increasing BMI will increase a person to risk of developing knee OA (10).

Based on the data obtained from 28 patients, there were 22 female sexes with a percentage of 78.6% and 6 male sex with a percentage of 21.4%. This result is in accordance with research conducted by Kumar et al. which states that statistically more women experience OA than men due to the tendency of women to be obese compared to men (9). This conformity was also found in Pontoh et al, study which found a ratio of women compared to men who experienced OA as much as 3:1 (11) Based on research by Jung et al, found that postmenopausal women have decreased estrogen levels which causes accelerated damage from the knee cartilage thereby increasing the risk of OA. Low estradiol content in post-menopausal women will increase the pain threshold in OA (12).

In the postoperative phase, all 28 patients were in the mild pain category (VAS: 1-3) with a percentage of 100%. In Ranawat grade 1, 2 and 3 all gave the same VAS score, that is the mild pain category. This is consistent with the research conducted by Ramlall et al. In which he reported pain scores in TKR pre operative patients had a significant result compared to after surgery. Ramlall et al found an average pain score in patients before surgery of 7 out of 10, and an average pain score after surgery of 3 out of 10 (13). One of the main indications of TKA is persistent pain that is often found in end-stage OA patients which cannot be treated with non-invasive methods (14,15). In this study there was a significant reduction in pain.

The comparative analysis results of this study between the pre operative range of motion of the knee joint 104.45 postoperatively showed a P value (significance) of 0.737, which means P > 0.05. This showed that the comparative test between the 2 groups was not significant. In the comparison of patients with osteoarthritis Ranawat grade 1, 2 and 3 for

improvement knee joint range of motion, there was no significant difference between the groups. According to the study of Redulescu et all, there was an increase in range of motion post knee osteoarthritis surgery with severe valgus deformity obtained an average result of pre operative 71° and postoperative 95° (16). This result is different from the study of Redulesce et al. It is possible that the factor in the existence of patients who are less cooperative in undergoing physiotherapy. That can cause less optimal knee range of motion. In patients who underwent total knee arthroplasty, surgery has been evaluated to obtain optimal knee ROM.

The results of the different tests between the KSS knee score and the KSS function score preoperatively and postoperatively showed a P value (significance) of 0,000, which means P < 0.05. This showed that the postoperative KSS experienced a significant improvement compared to the pre operative KSS. This is in accordance with research Redulescu et al who also found that knee osteoarthritis surgery with severe valgus deformity, KSS experienced an improved from a pre operative average of 21.3° to an average of 80.7° postoperatively (16). That means it could increase clinical outcomes in patients with knee osteoarthritis with valgus deformity who have performed total knee arthroplasty with non-constrained implants.

In this study, the test results different between the mechanical tibiofemoral angle (MTFA) on average preoperatively by 11.35° valgus and postoperative average of 0.17°

varus. The P value (significance) is 0,00, which means P < 0.05. This showed that MTFA experienced a significant change between pre and post operative. Mechanically aligned TKA's aim to have a neutral coronal plane alignment and a tibial cut that is orthogonal to the mechanical axis. In a valgus knee, both femoral and tibial pathology may need to be addressed with respective bone cuts to achieve this goal (3). In this study the total knee arthroplasty is underwent cutting both the tibia and the femoral is using templating, it is expected to restore the alignment of the neutral coronal plane.

In this study the correlation between improvement MTFA with improvement of the KSS Knee Score shows the P value (significance) is 0,000, which means P < 0.05, so it can be concluded that MTFA improvement is significantly related to improvement in the KSS Knee Score. Choong 2009 mentions that patients who achieved alignment in the mechanical angle 3° tibiofemoral axis increased the KSS. Orthopedic experts believe that good alignment (in 3° mechanical axis) TKA results in improved outcomes (9). One goal for TKA is to achieve good results in alignment of the femur, tibia and patella components by restoring the patient's lower extremities to neutral. Proper alignment of the knee joint is considered as one of the most influential factors in determining the long-term outcome after TKA (10). In this study the results of post-correction MTFA with mean valgus 2.78° and varus 3.61°.

Based on this study clinical outcome evaluation did not differ during the short-term evaluation, it needed a long-term follow-up evaluation to assess the clinical outcome. In this study the actioned of TKA with non-constrained implants in the valgus deformity are quite reliable with the requirement that the realignment correction performed can be achieved. Complications were found in this study. One patient experienced infection after operation and did not to stand properly so excluded to the study. Another complication was lack of knee joint ROM after surgery. There were 4 patients post operative with less than 90 knee joint ROM. Erkan et al mentioned that stiffness in the knee joint was a postoperative complication that occurred in 416% of patients with TKA and was a significant cause of morbidity due to pain and limited function.

Pre operative flexion range is limited, then stiff knee is more likely to occur in patients who will undergo TKA (17,18). Risk factors for stiffness after TKA can be divided into 3 groups pre operative factors, intraoperative factors and post operative factors (19). In these patients it is possible due to postoperative factors such as inadequate rehabilitation or physiotherapy with low patient motivation. Some limitations of this study are the limited number of patient samples, which is less than 30 patients. Evaluation of postoperative patient follow-up is quite short under 1 year; research is needed to continue with long-term evaluation. In addition, there isn't detailed data about the surgical technical procedures that have been performed.

CONCLUSIONS

Based on this study total knee arthroplasty with non-constrained implant on knee osteoarthritis valgus deformity provides significant result in reducing pain scale and increased clinical outcome. TKA with non-constrained implants in the valgus deformity are quite reliable with the requirement that the realignment correction performed can be achieved.

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