COMPARISON OF CLINICAL OUTCOMES BETWEEN PARALLEL JOINT LINE TO THE FLOOR AND OBLIQUE JOINT LINE AFTER COMPUTER ASSISTED SURGERY TOTAL KNEE ARTHROPLASTY : PRELIMINARY STUDY

Pornpavit Sriphirom MD[1*], Pawit Yuangngoen MD[1], Sorawut Sirisak MD[1],Chaiyaporn Siramanakul MD[2], Thakrit Chompoosang MD[1] , Anuchit Vejjaijiva MD[1]

[1]*Department of orthopaedic surgery, Rajavithi hospital, Rangsit University, Bangkok, Thailand, 10400, Email: pornpavit@yahoo.com

[2] Department of orthopaedic surgery, Banphaeo Hospital (Prommitr Branch), Bangkok, Thailand

INTRODUCTION

Restoration of neutral mechanical alignment is traditionally considered as a successful total knee arthroplasty (TKA) and durable implant. However, published work by Bellemans et al[1] revealed that 32% of men and 17% of women has mechanical alignment of 3°varus and more in normal asymptomatic population. These people have so-called "constitutional varus" knee. Victor et al[2] observed that parallel joint line to the floor could be found in both neutral alignment and constitutional varus asymptomatic population. Conversely, advanced medial arthritis knee can cause oblique joint line to the floor. This means joint line orientation may play a more important role than restoration neutral alignment after TKA. Particularly, achieving neutral alignment in constitutional varus group may be not natural for them. A more individually based anatomical reconstruction might be more efficient for optimal ligament balancing and kinematics. Constituting joint line to the floor in TKA was introduced by Hungerford et al[3]. His anatomical method is based on fact that proximal tibial plateau is in 3°varus to tibial mechanical axis, then resection for TKA involving with 3°varus for tibial cut. However, there is no study documenting whether joint line parallel to the floor after TKA has different clinical results from oblique joint or not. Therefore, this study aims as following 1) to compare clinical outcomes between patients with neutral mechanical alignment and varus alignment after computer assisted surgery TKA (CAS TKA), 2) to compare clinical outcomes between patients with classical tibial cut and anatomical tibial cut in CAS TKA, and 3) to compare clinical outcomes between parallel joint line to the floor and oblique joint line after CAS TKA.

MATERIALS AND METHODS

This prospective study was conducted on 94 primary varus osteoarthritis knees scheduled to receive TKA with navigation (Orthopilot 4.4, B.Braun, Aesculap, Tuttlingen, Germany) from June 2013 to June 2014. Three types of TKA designs were used, consisting of 1) posterior stabilized (PS) prosthesis, 2) mobile PS prosthesis, and 3) mobile cruciate retaining (mobile CR) prosthesis. All procedures were carried out by modified gap technique with tibial cut first. For extension gap balance was performed with osteophyte removal and released deep medial collateral ligament (MCL). While flexion gap balance was using femoral rotation and never been released superficial MCL. All patients were mainly classified into 2 groups by different TKA method. First group was performed TKA with tibial cut perpendicular to tibial mechanical axis (Classical method). Whereas the second group, tibial cut was planned at 3° varus to mechanical axis of tibia (anatomical method). Clinical outcomes as WOMAC scores, Oxford knee scores and range of motion (ROM) were determined before surgery and 6

months later. Radiographic evaluations were taken preoperatively and 6 months postoperatively by using hip-knee-ankle digital radiograph with full leg standing to measure coronal mechanical alignment, tibial cut angle in coronal alignment, and tibial joint line angle (TJLA). The TJLA in coronal plane is the angle formed between parallel to the floor and tangential to medial and lateral tibial tray. Cobb angle was used in calculation and defined as TJLA parallel to the floor (Cobb angle, 0-2°) and oblique joint line (Cobb angle,> 2°). We compared difference between radiographic parameter in terms of clinical outcomes as following 1) to compare mechanical axis alignment between neutral coronal mechanical alignment (mechanical axis, 0±3°), 4-5° varus alignment and ≥ 6°varus alignment, 2) to compare tibial cut angle between classical tibial cut (tibial cut angle, 0-1°varus) and anatomical cut (tibial cut angle, ≥ 2°varus), and 3) to compare joint line orientation between postoperative parallel joint line and oblique joint line to the floor.

RESULTS

51 knees were performed CAS TKA with classical method and 43 knees with anatomical method. The implant distribution was PS (5.88%), mobile PS (74.47%) and mobile CR (17.64%) in classical group. In anatomical group was used PS (23.26%), mobile PS (53.49%) and mobile CR (23.26%). For postoperative mechanical axis alignment, there was no statistically significant difference between neutral alignment, 4-5°varus and ≥6°varus alignment in terms of WOMAC scores, Oxford scores and ROM. However, for clinical improvement outcomes, it is revealed that 6°varus alignment group had more significant improvement in WOMAC scores than neutral alignment group (p=0.37). For comparison of tibial cut angle, there was no statistically significant difference between classical tibial cut (0-1° varus) and anatomical tibial cut (≥ 2°varus) in terms of clinical outcomes. Nevertheless, an anatomical tibial cut group had more significant improvement in WOMAC scores than classical tibial cut group (p=0.017). For comparison of tibial joint line orientation, there was no significant difference between postoperative parallel joint line and oblique joint line in terms of clinical outcomes. However, the study found that parallel joint line had more significant improvement in WOMAC scores than oblique joint line (p=. 000).

	Median Preop WOMAC	Median Preop OXFORD	Median Preop ROM	Median Womac score	Median Oxford score	Median ROM	WOMAC gain score	Oxford gain score	ROM gain score
Mechanical axis neutral (0-3)	66.00	17.00	105.28	7.00	42.00	124.00	-54.00	25.00	14.00
Mechanical axis varus (4-5)	69.00	19.00	108.00	8.00	41.00	120.00	-51.50	22.00	11.00
Mechanical axis varus (≥ 6)	71.00	16.00	106.00	6.00	43.00	120.00	-63.00	26.00	10.00
P value	0.155	0.04	0.420	0.967	0.571	0.349	0.035	0.045	0.126
Tibial cut angle (0-1)	67.00	18.00	107.00	8.00	43.00	124.00	-53.00	25.00	12.00
Tibial cut angle(≥2)	72.00	16.00	106.00	5.00	41.00	119.00	-64.00	25.00	9.00
P value	0.034	0.695	0.778	0.516	0.283	0.173	0.017	0.394	0.033
Tibial joint line angle (0-2)	73.00	15.00	110.00	6.00	40.00	120.00	-66.00	25.00	9.00
Tibial joint line angle (≥ 3)	67.00	18.00	105.00	8.00	43.00	124.00	-52.00	25.00	13.00
P value	0.012	0.128	0.129	0.320	0.067	0.195	0.000	0.523	0.055

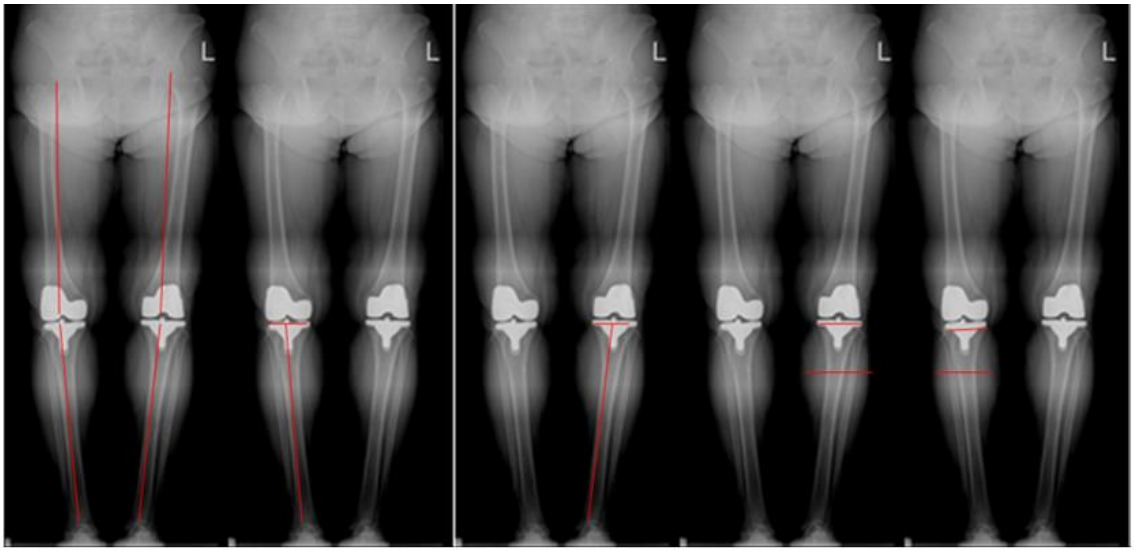

Figure1. A: Postoperative mechanical axis measurement, B: Tibial cut angle measurement: 90 ^{0} to tibial mechanical axis, C: Tibial cut angle measurement: 3 ^{0} varus tibial cut, D: Tibial joint line angle measurement: 2 ^{0} tibial joint line angle (parallel joint line to the floor), E: Tibial joint line angle measurement: 6 ^{0} tibial joint line angle (oblique joint line to the floor)

DISCUSSION

According to our results, we compared outcomes of neutral mechanical alignment and varus alignment after CAS TKA and found no clinical differences between 3 alignment groups. Moreover, WOMAC scores in ≥6°varus alignment group was significantly improved more than neutral alignment group, because preoperative varus deformity was significantly greater than others (Median preoperative mechanical axis ≥6°varus = 20^0, 4-5^0 varus = 15^0, neutral = 11^0). Therefore, in severe varus knees may not be necessary to restore limb alignment to neutral in order to avoiding instability due to excessive soft tissue release. This finding is in

consistent with previous study by Parrate et al.[4] demonstrated no difference in survival at 15 years following up for knees aligned within neutral alignment compared with outlier group. Anatomical tibial cut methods and classical tibial cut methods were found no clinical difference, similarly to study by Ji-Hyun Yim et al.[5] in Robotic TKA. Nevertheless, anatomical tibial cut methods improved more WOMAC scores than classical tibial cut methods. Tibial joint line parallel was significantly improved more WOMAC scores than oblique joint line even though the postoperative WOMAC scores were not significant difference. Therefore, joint line orientation may be one of key success factors in TKA. However, this concept needs to further study by increasing the number of patients and a longer follow up time.

REFERENCES

1. Bellemans J, Colyn W, Vandenneucker H, Victor J. The Chitranjan Ranawat award: is neutral mechanical alignment normal for all patients? The concept of constitutional varus. Clin Orthop Relat Res, 470, pp:45–53, 2012.
2. Victor J M, Bassens D, Bellemans J, Gursu S, Dhollander A A, Verdonk P C. Constitutional Varus Does Not Affect Joint Line Orientation in the Coronal Plane, Clin Orthop Relat Res, 472, pp:98–104, 2014.
3. Hungerford D S, Krackow K A. Total Joint Arthroplasty of the Knee Clin Ortho Rel, 192, pp: 23-33, 1985.
4. Parrate S, Pagnano M W, Trousdale R T, Berry D J. Effect of Postoperative Mechanical Axis Alignment on the Fifteen-Year Survival of Modern, Cemented Total Knee Replacements The Journal of Bone and Joint Surgery Am, 92, pp:2143 – 2149, 2010.
5. Yim J H, Song E K, Khan M S, Sun Z H, Seon J K. A comparison of Classical and Anatomical Total Knee Alignment Methods in Robotic Total Knee Arthroplasty. The Journal of Arthroplasty, 28, pp:932-937, 2013.

DISCLOSURES

The authors did not receive any outside funding or grants in support of their research for or preparation of this work.