Bi-cruciate substituting total knee arthroplasty improved anteroposterior displacement in mid-flexion range

Keinosuke Ryu[1,2]

Cho Eiji[1], Takanori Iriuchisima[2], Kazuyoshi Nakanishi[1]

1) Dept of Orthop Surg, Nihon University Hospital, Tokyo, Japan
2) Dept of Orthop Surg, Kamimoku Spa Hospital, Gunma, Japan

2023 ISAKOS Congress in Boston

Disclosure of Conflict of Interest

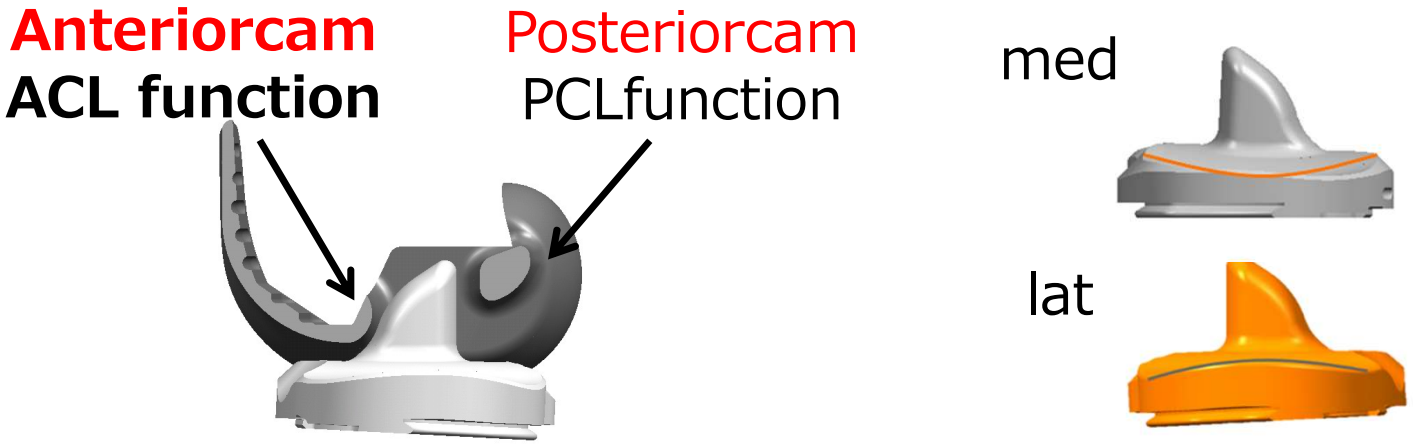
Name of first author: **Keinosuke Ryu**

I have no COI
with regard to our presentation.

Introduction

Total knee arthroplasty (TKA) is reported to be an effective procedure for treating osteoarthritis of the knee that provides excellent pain relief and reliable long-term results. However, postoperative patient satisfaction is lower than that for total hip arthroplasty (THA), with 10%–20% of patients reportedly left dissatisfied after TKA. This may be because, although it is currently possible to choose between retaining the posterior cruciate ligament (PCL) or replacing it (cruciate-retaining or posterior cruciate-substituting surgery), the anterior cruciate ligament (ACL) must always be resected, meaning that ACL dysfunction is present in all post-TKA knees. As a result, conventional TKA cannot normally achieve kinematics or function equivalent to that of a healthy knee, and ACL defects may also cause abnormal tibiofemoral positioning and anterior knee laxity. This may lead to postoperative knee dysfunction, reducing patient satisfaction.

Purpose



JOURNEYⅡ BCS

Bi-Cruciate Substituting (BCS) TKA has a cam-post structure designed to possess the functions of both the ACL and the PCL, reproducing the kinematics, function, and stability of a healthy knee. Several studies have reported that it shows similar knee kinematics in BCS-TKA as in normal knee function and favorable clinical results. However, no study has yet addressed the question of anteroposterior (AP) joint displacement. The aim of this study is to compare the AP joint displacement between a n BCS-TKA and cruciate-retaining Oxford unicompartmental knee arthroplasty (UKA) and PCL-retaining (CR) TKA and PCL-substituting (PS) TKA.

Materials

102 cases 160 knees

Who underwent surgery using the BCS-TKA procedure after 2016

Diagnosis : Osteo Arthritis
Sex : Male 26 cases 32 knees
Female 76 cases 128 knees
Age : 74.8 yrs. (58-96)
Follow : 6.8 yrs. (6.1-7.9)
BMI : 26.8 kg/㎡ (17.7-36.8)
FTA : 183.9°(177°–200°)

Materials

	BCS	Oxford UKA	FNK CR	FNK PS	Healthy
					
n=	**160**	89	93	63	53
age	**74.8**	71	77.4	77.8	71
Gender					
Male	**32**	22	29	18	16
Female	**128**	67	54	45	37
Pre diag					
OA	**160**	89	93	63	-
Pre-ROM	**122.7**	126.1	120.8	114.2	144.3

Methods

- AP joint displacement was measured using the KT-1000 arthrometer at **30 in flexion**.
- An anterior force of **67N, 133N, manual maximum** was applied.

KT-1000 arthrometer

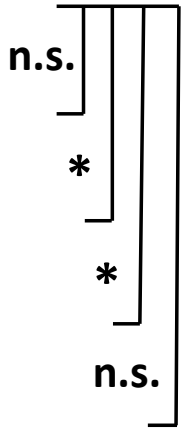
(MEDmetric Corp., San Diego, CA, USA)

Result

	BCS	UKA	CR	PS	Healthy
					
67 N	**4.3** ±1.1	**3.9** ±1.0	**6.3** ±1.8	**4.8** ±1.4	**4.0** ±1.4
134 N	**6.7** ±1.4	**6.0** ±1.5	**9.2** ±2.2	**7.2** ±1.6	**6.1** ±1.6
Max	**10.6** ±1.4	**9.8** ±1.4	**14.3** ±2.4	**12.2** ±2.2	**9.4** ±1.7

AP joint displacements

	67 N	134 N	MAX
BCS	**4.3**	**6.7**	**10.6**
UKA	**3.9**	**6.0**	**9.8**
CR	**6.3**	**9.2**	**14.3**
PS	**4.8**	**7.2**	**12.2**
Healthy	**4.0**	**6.1**	**9.4**



***p<0.05**

No significant difference in AP joint displacements was observed among the **BCS and UKA and control groups**. And there was **significant difference** between **BCS and CR, BCS and PS groups.**

Discussion

The Roliometer: anew arthrometer compared with the KT-1000

A Ganko, KSSTA 2000

Age **27.4** (16-42), **38** cases

KT-1000 Max @ 25°	
Healthy	**6.9** ± 1.6 mm
ACL injured	**11.4** ± 2.9 mm

AP joint displacements of **BCS was similar to Healthy knees** and **CR and PS were similar to ACL injured knees.**

Limitation

- Back grounds of between the groups does not match.
- Evaluation of only 30° flexion and anterior-posterior direction.
- Assessed only in supine position.
- Unclear correlation with clinical outcome.

Conclusion

- BCS-TKA showed no significant difference in AP joint displacement when compared with control knees and Oxford UKA knees.

- The BCS-TKA design is likely to reproduce native anterior cruciate ligament and posterior cruciate ligament function, and improve the AP joint stability in mid-flexion range.

References

- *Wylde V, et al. Patient-reported outcomes after total hip and knee arthroplasty: comparison of midterm results. J Arthroplasty 2008*
- *Hosaka K, et al. Asian-specific total knee system: 5-14 year follow-up study. BMC Musculoskelet Disord 2011*
- *Sanders TL, et al. Incidence of Anterior Cruciate Ligament Tears and Reconstruction: A 21-Year Population-Based Study. Am J Sports Med 2016*
- *Takubo A, et al. Comparison of Muscle Recovery Following Bi-cruciate Substituting versus Posterior Stabilized Total Knee Arthroplasty in the Asian Population. J Knee Surg 2017*
- *Inui H, et al. Preoperative and intraoperative factors contributing to patient satisfaction after bi-cruciate stabilized total knee arthroplasty. J Orthop Surg 2021*
- *Ganko A, et al. The rolimeter: a new arthrometer compared with the KT-1000. Knee Surg Sports Traumatol Arthrosc 2000*