Changes In CPAK Classification and Its Characteristics before and after Kinematic Alignment TKA.

Manabu Akagawa[1)], Yasuhiro Takahashi[1)], Yosuke Iwamoto[1)], Junpei Iida[1)], Takayuki Yoshikawa[1)], Toshiki Abe[1)], Hidetomo Saito[2)], Yuji Kasukawa[2)], Naohisa Miyakoshi[2)]

1) Omagari kousei medical center/Department of Orthopedic Surgery

2) Akita University Graduate School of Medicine/Department of Orthopedic Surgery

ISAKOS CONGRESS 2023

Boston Massachusetts June 18–June 21

Presenter Disclosure Information

[Presenter : Manabu Akagawa]

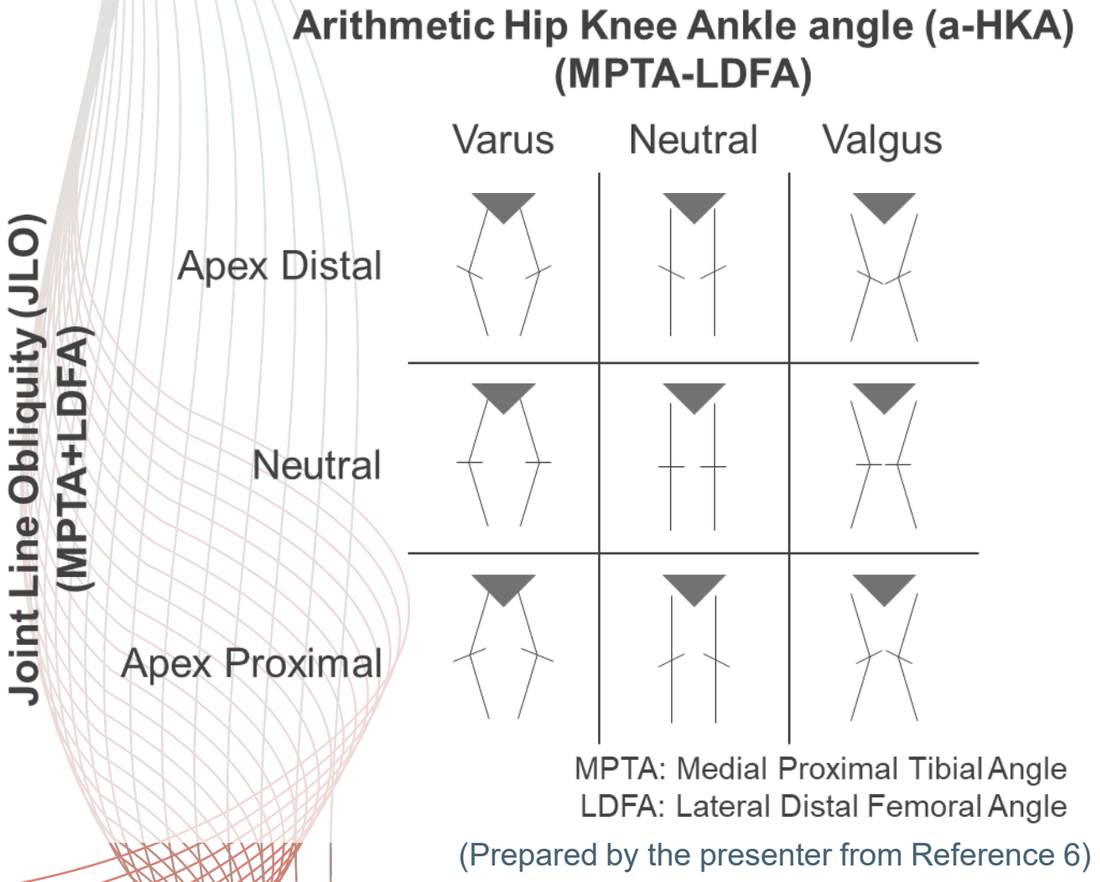
disclose no conflict of interest.

Kinematic Alignment (KA) TKA

- The KA technique aims to restore the pre-arthritic patient's constitutional knee alignment .

- Previous papers have reported better clinical scores and functional recovery with the KA-TKA than with the Mechanical alignment (MA) TKA [1-5].

Coronal Plane Alignment of the Knee (CPAK)



(Prepared by the presenter from Reference 6)

- The CPAK classification classifies coronal alignments into nine phenotypes based on the combination of arithmetic Hip Knee ankle angle (aHKA) and Joint line obliquity (JLO) calculated from MPTA and LDFA [6] .

- CPAK classification has been reported to be useful in predicting constitutional alignment in osteoarthritis (OA) patients [7], and thus, may be useful in the postoperative evaluation of KA-TKA.

Purpose of the study

- Therefore, in this study, we investigated the changes in CPAK classification and alignment parameters before and after KA-TKA, and compared them with previous reports.

Methods

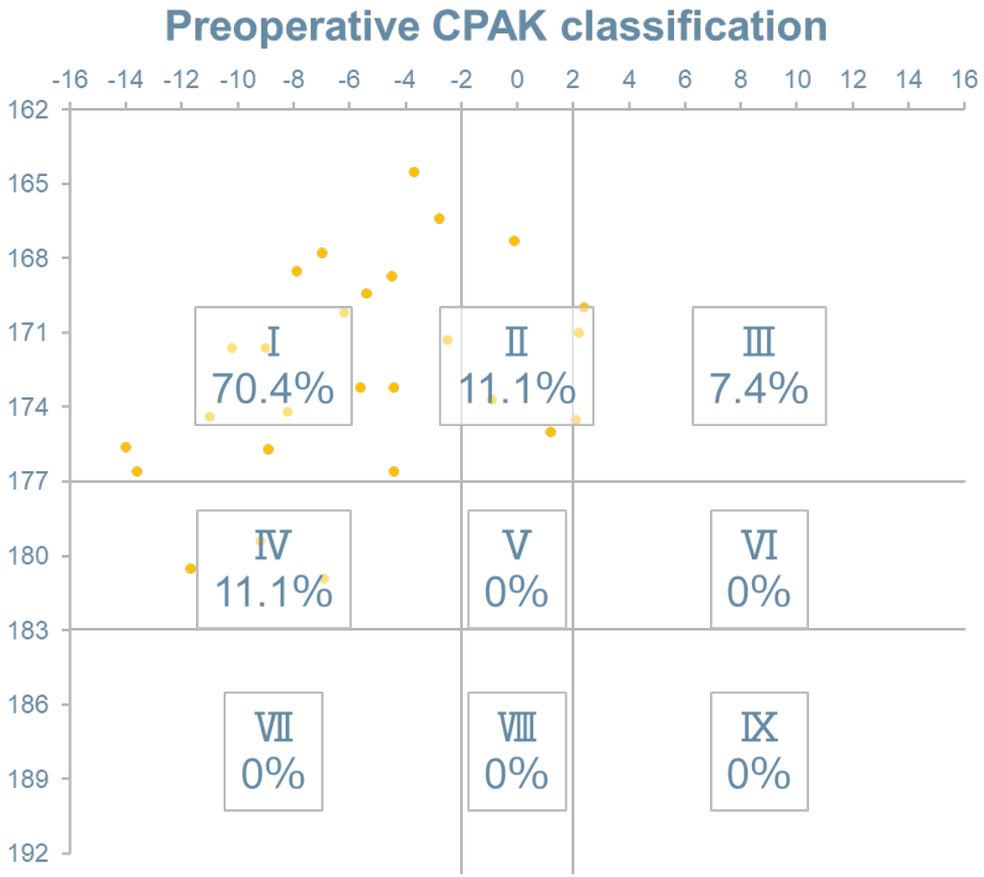
- We included the patients who underwent calipered True KA-TKA [8] from September 2021 to July 2022.
- Total of 27 cases, 27 knees (3 males and 24 females), with an average age of 76 years were included.

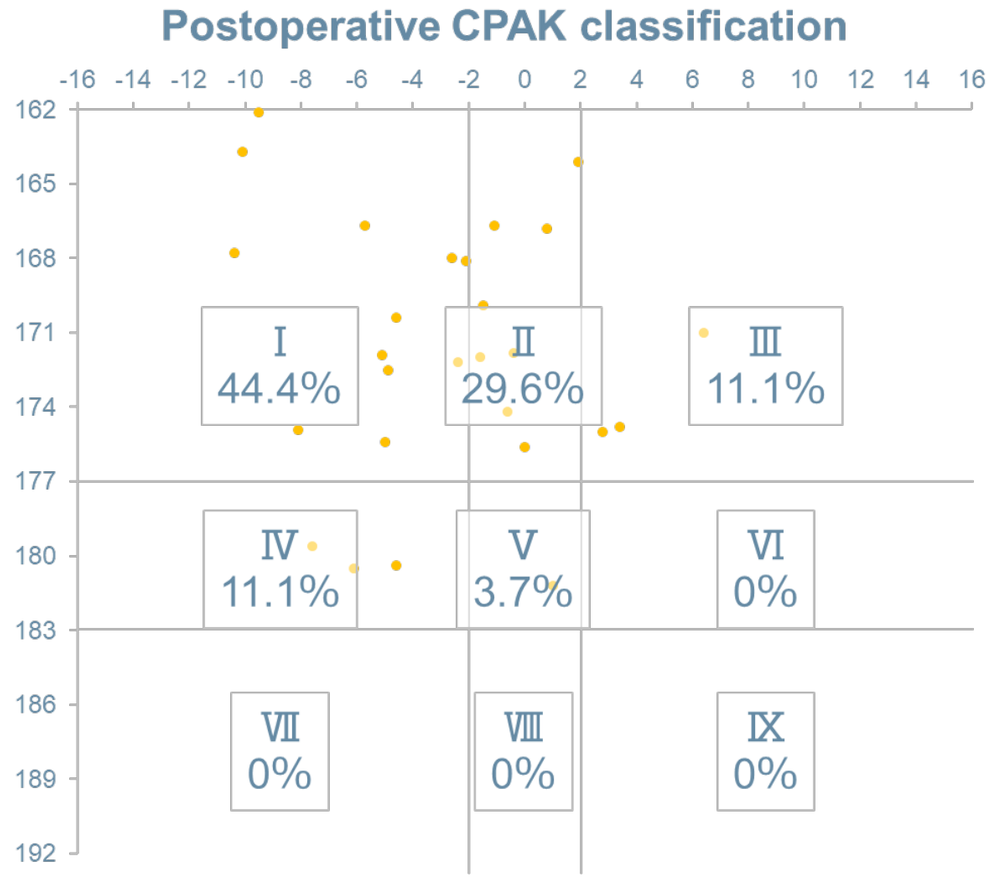
The following items were evaluated to examine the distribution of CPAK classification and alignment parameter changes：

- mechanical HKA (mHKA)
- %Mechanical Axis (%MA)
- MPTA
- LDFA
- aHKA（＝MPTA-LFDA：varus＜－2°，neutral＝0±2°，valgus＞2°）
- JLO（＝MPTA＋LFDA：apex distal＜177°，neutral＝180±3°，apex proximal＞183°）

Results

Distribution and changes of CPAK classification





Results

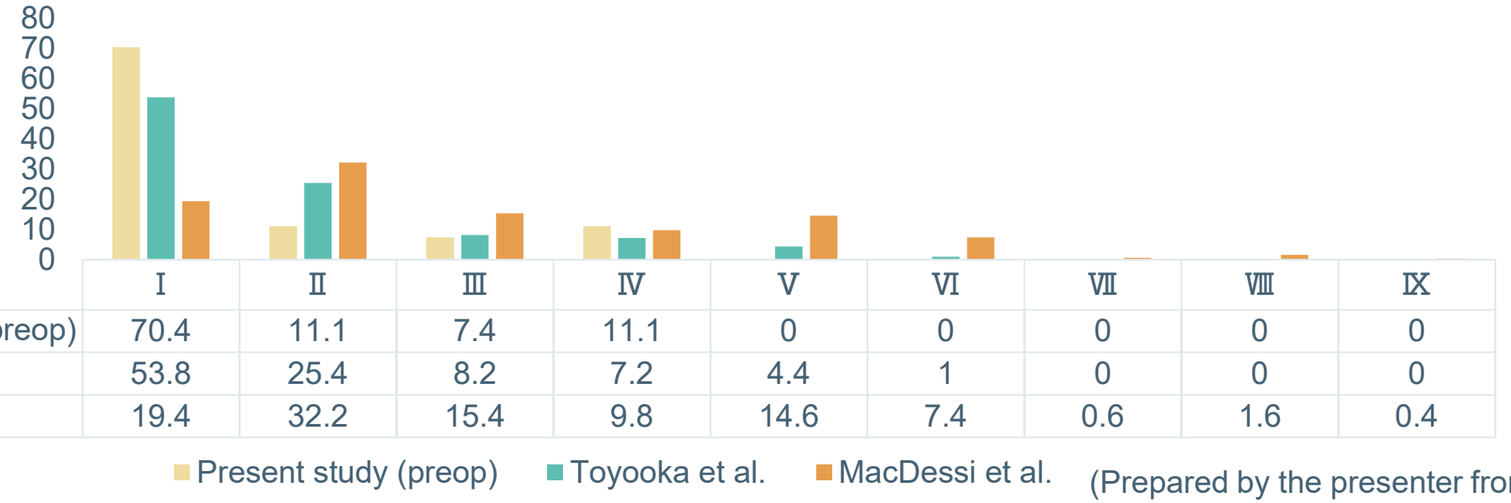
Changes of alignment parameters

	Pre	Post	*p value (t-test)*
mHKA	-10.3 ± 6.2	-2.9 ± 4.5	< 0.001
%MA	5.4 ± 26.3	37.4 ± 19.0	< 0.001
MPTA	83.5 ± 2.5	84.4 ± 3.6	0.179
mLDFA	89.1 ± 3.7	87.3 ± 3.1	< 0.001
JLCA	4.8 ± 2.7	0.1 ± 0.3	< 0.001
aHKA	-5.6 ± 4.7	-2.9 ± 4.3	< 0.01
JLO	172.7 ± 4.2	171.8 ± 5.2	0.159

- All alignment parameters except MPTA were significantly corrected, and JLO was maintained in 96.3% of the cases.

Discussion

Comparison of CPAKclassification distribution of OA patients



	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅴ	Ⅵ	Ⅶ	Ⅷ	Ⅸ
Present study (preop)	70.4	11.1	7.4	11.1	0	0	0	0	0
Toyooka et al.	53.8	25.4	8.2	7.2	4.4	1	0	0	0
MacDessi et al.	19.4	32.2	15.4	9.8	14.6	7.4	0.6	1.6	0.4

(Prepared by the presenter from Reference 6,8)

・Compared with previous reports of OA knees, type I was the most common in preoperative CPAK classification of this study, similar to the report of Toyooka et al. The Japanese OA patients have strong varus deformity.

Discussion

Comparison of postoperative alignment and healthy knee data

	Japanese		Bergium	US
	Present study (postop)	Wanezaki Y et al.	Bellmans J et al.	Cooke TD et al.
mHKA	-2.9	-2.3	-1.3	-1.0
%MA	37.4	36.3	-	-

(Prepared by the presenter from Reference 9-11)

・Comparing the postoperative alignment in the present study with previous reports of healthy knees, our results were closer to the Japanese alignment reported by Wanezaki et al. [9] although the varus deformity was stronger than that of Westerners[10,11].

・True KA-TKA restored Japanese physiological alignment.

Discussion

- In Japanese patients with strong varus deformity, MA-TKA often requires excessive soft tissue dissection to achieve neutral alignment and JLO, whereas KA-TKA which respect soft tissue, maintained JLO and achieved Japanese constitutional alignment.

- These features of KA-TKA may lead to the good recovery of postoperative knee sensation [12] and better reproduced gait kinematics [13] as reported previously.

Conclusions

- We compared CPAK classification and alignment parameters before and after True KA-TKA.

- Similar to previous Japanese OA knee data, type I was the most common preoperative CPAK classification.

- The postoperative alignment was close to the Japanese constitutional alignment, and the physiological joint line obliquity was maintained.

- These features in this study may contribute to the clinical results of the KA-TKA.

References

1) Takahashi T et al. J Knee Surg. 2018;31:999-1006.
2) Dossett HG et al. Bone Joint J. 2014;96:907-913.
3) Calliess T et al. KSSTA. 2017;25:1743-1748.
4) Courtney PM et al. J Arthroplasty. 2017;32:2028-2032.
5) Riviere C et al. OTSR. 2017;103:1047-1056.
6) MacDessi SJ et al. Bone Joint J. 2021 Feb;103-B(2):329-337.
7) MacDessi SJ et al. Bone Jt Open. 2020 Nov 2;1(7):339-345.
8) Toyooka S et al. J Knee Surg. 2022 Feb 3.
9) Wanezaki Y et al. J Orthop Sci. 2023 Jan;28(1):200-203.
10) Bellmans J et al. Clin Orthop Relat Res. 2012 470(1):45-53.
11) Cooke TD et al. Orthop Clin North Am. 1994 Jul;25(3):387-93.
12) Mercuri JJ et al. JBJS Review. 2019;7(3):e2.
13) Blakeney W et al. KSSTA. 2019;27:1410-1417.