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The Effects of the Flexion Gap Setting on Postoperative Outcomes of TKA Using the Mako Robotic Arm

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Nothing to disclosure for all author

NARA MEDICAL UNIVERSITY
Established 1954
ORTHOPAEDIC SURGERY

Introduction

- In recent years, robotic arm-assisted total knee arthroplasty (RA-TKA) is being introduced.

- We have been performing Mako robotic arm-assisted TKA since October 2021.

- In RA-TKA, the gap balance can be freely set during surgery, allowing placement planning of the femoral and tibial components to be performed with high accuracy. We investigated whether there is a difference in clinical outcomes between different joint gaps using the Mako robotic arm.

Material

45 patients (7 males and 38 females,mean age 74.3 years)

observed for 6 months after performing CR type TKA with Mako robotic arm-assisted system

All cementless TKA (CR type, non patella resurfaced)

Approach ： Trivector approach

Counter-measure of hemostasis：Tranexamic acid 1g intra-articular injection

Average operation time：53min. （37～85min.）

Group A (21 cases, 29 knees) :Osteotomy with the same value of medial flexion gap and extension gap

Group B (24 cases, 29 knees) :Osteotomy with a medial flexion gap 1mm larger than the extension gap

*No significant differences in patient factors between the two groups

Method

- Research items

  Knee joint range of motion (ROM)

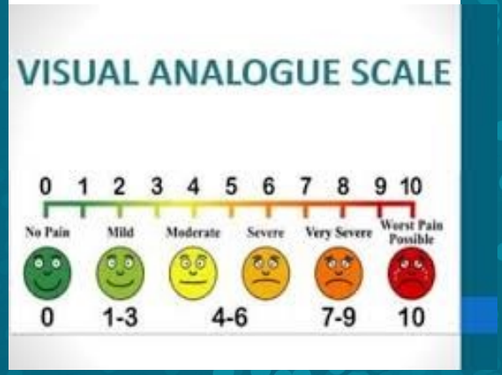
- Evaluation Criteria

  Pain Visual Analogue Scale（VAS）

  Forgotten Joint Score(FJS-12)

  MOS 36 Short-Form Survey(SF-36)

  Japanese Knee injury and Osteoarthritis Outcome Score (J-KOOS)



Result

Group A	preoperative	discharge	3 months after surgery	6 months after surgery
Flexion angle	122.1	123.6	118.1	121.9
Extension angle	-8.3	-3.8	-2.4	-2.7
VAS （at rest）	8.9	5.4	2.0	1.27
VAS （at exercise）	44.8	12.2	* 8.3	11.73
FJS-12	24.2	37.3	43.1	44.5

Group B	preoperative	discharge	3 months after surgery	6 months after surgery
Flexion angle	129.3	123.8	123.9	123.7
Extension angle	-4.7	-3.9	-3.5	-2.3
VAS （at rest）	17.6	3.7	5.5	3.08
VAS （at exercise）	50.1	20.3	*19.6	8.23
FJS-12	17.7	26.2	43.1	36.5

＊P＜0.05

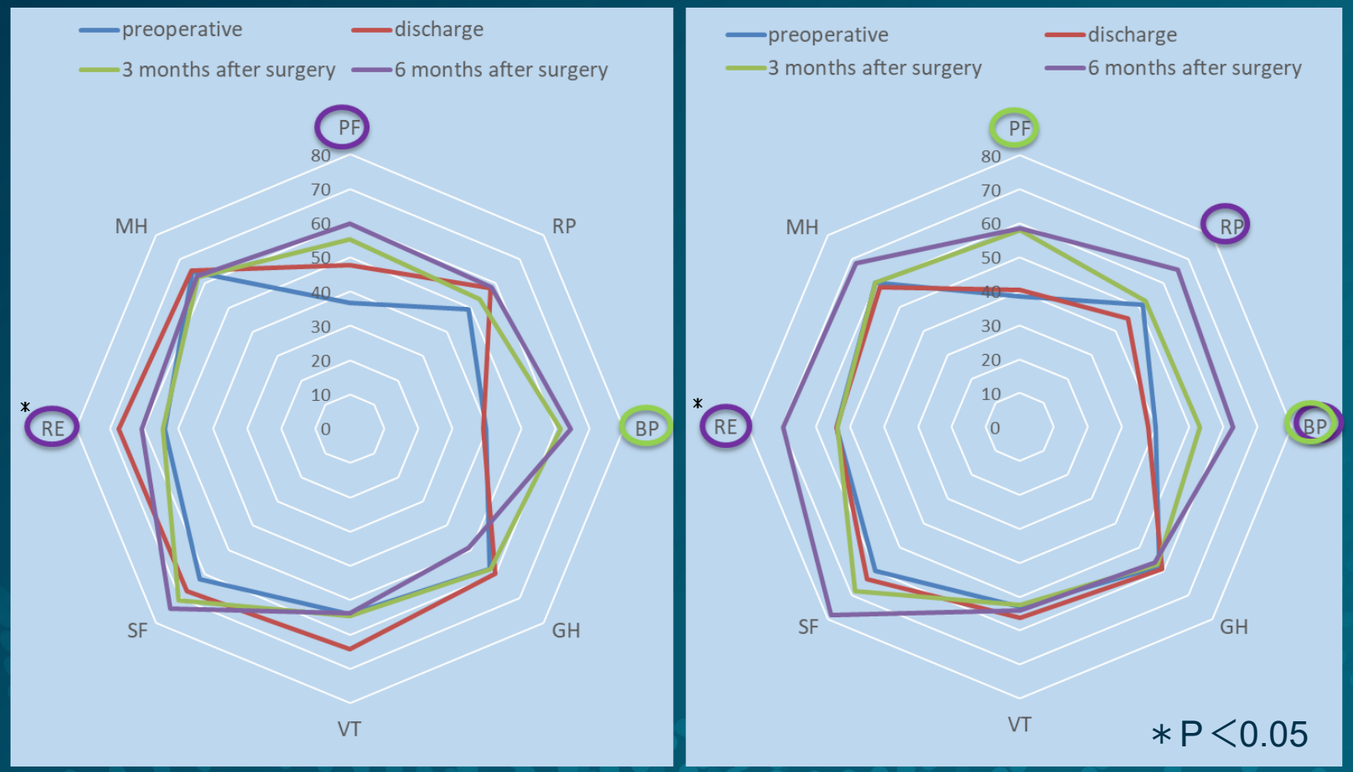
The extension angle improved significantly in Group A（- 8.3±6.0° →-3.8±3.7° →2.6±3.5° ） until 3 months after surgery and reached its peak.

Pain VAS (exercise) was significantly different at only 3 months after surgery in Group A (6.0±9.5) and Group B (22.0±20.5).

FJS-12 improved significantly at discharge in both Group A and Group B (GroupA:24.2±16.0→37.3±23.5GroupB:17.7±11.5→26.2±18.2) .

Result

SF-36



3 months after surgery

Group A ：Body Pain

Group B ：Physical Functioning , Body Pain

6 months after surgery

Group A :Physical Functioning , Role Emotional

Group B :Role Physical , Body Pain , Role Emotional

➡ All of the above improved significantly.

There was a significant difference in only Role Emotional at 6 months after surgery in Group A and B(60.8±32.3 and 69.6±34.2).

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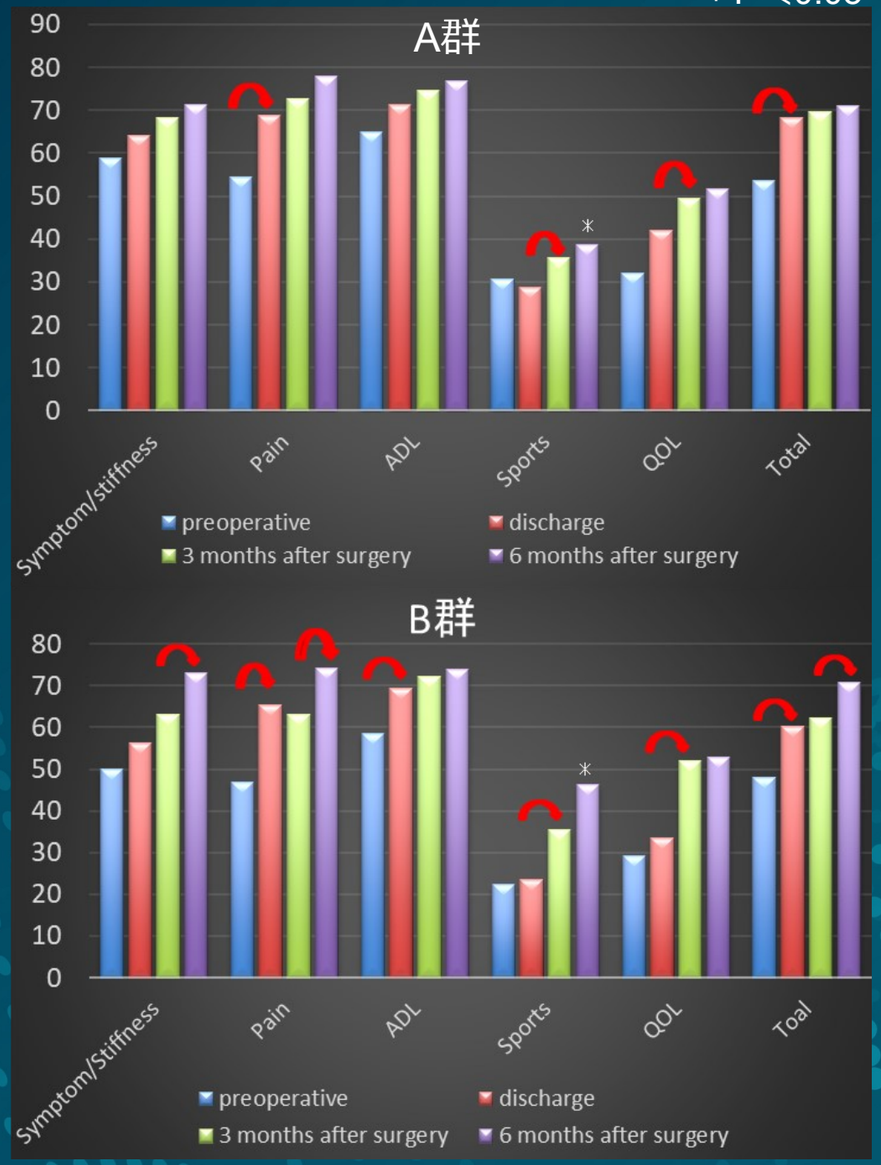
Result

・J-KOOS

＊P＜0.05



・ At discharge， there are significant improvement in Pain and Total in Group A and Pain, ADL and Total in Group B at discharge.

・At 3 months after surgery, both Group A and Group B showed significant improvement in Sports and Quality of Life.

・At 6 months after surgery, Symptom/Stiffness, Pain, Sports, and Total were significantly improved in Group B.

・ The only significant difference between the two groups was in Sports at 6 months postoperatively.

Discussion

Although the flexion gap is usually larger than the extension gap in manual TKA, the use of robotic arm allows for accurate bone resection and minimal soft tissue damage, resulting in little error in the extension and flexion gap.

Manual TKA improved postoperative flexion angles more markedly than RA-TKA. (※1)

due to a looser flexion gap ?

From our study, a 1 mm difference in extension and flexion gap had no effect on the flexion angle.

In the past literature, …

The average 1.5 mm extension/flexion gap difference did not significantly differ in flexion angle at 4 weeks postoperatively. (※2)

The postoperative flexion angle may be further improved by further increasing the extension/flexion gap difference by a few millimeters.

Discussion

Although there were no significant differences between the two groups in this study, more items in group B showed significant improvement in both SF-36 and J-KOOS.

A significant difference between the two groups could occur if a larger number of patients were evaluated.

Discussion

We focused on the difference in the extension-flexion gap as the reason for the superior improvement in the postoperative flexion angle of manual TKA compared to robotic RA-TKA.

Other possible causes….

- ✓ the invasion of the quadriceps muscle by the bone pins for array placement
- ✓ the prolonged operation time compared to manual TKA

→ We need to simultaneously consider and address factors other than the post-osteotomy extension/flexion gap difference.

Conclusion

- The effect of flexion gap setting on postoperative outcomes in Mako RA-TKA was investigated based on patient-standing assessments and changes over time.
- In the change over time of the patient-derived outcomes used in this study, all of these outcomes showed significant improvement in all groups.
- A post-osteotomy extension-flexion gap difference of about 1 mm had no effect on the flexion angle.

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Reference

※1M.Okuda，et al.： Journal of Joint Surgery and Research，66：663-664，2023

※2Y.Shida，et al.： Orthopedics & Traumatology，62（3）446-449，2013

Thank you for watching

my presentation ！