

# Postoperative rehabilitation of anterior cruciate ligament reconstruction using AI brace in COVID-19 outbreak

Wei-Jen Liao, Chao-Ping Chen<sup>1</sup>, Leo Shaw<sup>2</sup>  
<sup>1</sup>Taichung Veterans General Hospital, <sup>2</sup>Orthopedics

**INTRODUCTION:** With the 2019 novel coronavirus (COVID-19) pandemic spreading quickly around the world, most of the patients had voiced their reluctance to visit the rehabilitation center postoperatively. Our purpose is to investigate artificial intelligence (AI) brace with home-based telerehabilitation would lead to equivalent effective clinical outcomes than the standard hospital-based rehabilitation program.

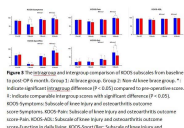
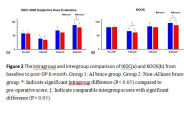
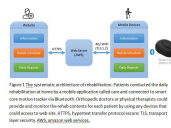
## METHODS:

A retrospective cohort study enrolled a total of 30 patients received anterior cruciate ligament (ACL) reconstruction, including 15 patients using AI brace and the others using regular knee brace from January 2020 to September 2020. All patients underwent arthroscopic ACL reconstruction with autologous quadruple hamstring tendons by an experienced orthopedics surgeon. Patients with AI brace received the home-based rehabilitation through the system connect to smart phone. Regular knee brace group received the rehabilitation program at our institution once a week. Rehabilitation protocol was scheduled in 6 months after surgery. Clinical knee functional scores were assessed during patient visits and analyzed.

## RESULTS:

At postoperative 6 month follow-up, superior results of both IKDC score and KOOS were noted in AI brace group in comparison to regular knee brace group (IKDC:  $87.84 \pm 5.55$  and  $79.49 \pm 9.11$ ,  $P = 0.003$ ; KOOS:  $95.59 \pm 4.19$  and  $87.13 \pm 14.40$ ,  $P = 0.004$ ). With the exception of KOOS-ADL, patients in AI brace group demonstrated superior results of all other subscales with significance than the regular knee brace group. The patients enabled to TAS level 5 were 14 (93.3%) in AI brace group and 11 (73.3%) in regular knee brace group respectively.

**DISCUSSION AND CONCLUSION:** Our experience demonstrated the advantage of telerehabilitation over compared to the standard hospital-based rehabilitation program after ACL reconstruction surgeries under the COVID-19 pandemic circumstances.



**Table 1. Characteristics of preoperative patients**

	AI brace	Regular knee brace	P-value
Age (years)	31	31	
Mean ± SD	29.27 ± 9.19	29.98 ± 9.20	0.862
Gender	14	16	
Female	14	16	
Male	1	0	
Range	17-47	17-50	
No. of quadruple grafts	15	15	0.797
No. of quadruple grafts	17	7	0.008
No. of quadruple grafts	12	12	1.000
No. of quadruple grafts			
No. of quadruple grafts			
No. of quadruple grafts			

**Table 2. Postoperative comparison of IKDC and KOOS between AI brace and regular knee brace**

	Mean ± SD	Mean ± SD	P-value
IKDC			
Total	87.84 ± 5.55	79.49 ± 9.11	0.003
ADL	87.84 ± 5.55	79.49 ± 9.11	0.003
Sport/Rec	87.84 ± 5.55	79.49 ± 9.11	0.003
QoL	87.84 ± 5.55	79.49 ± 9.11	0.003
KOOS			
Total	95.59 ± 4.19	87.13 ± 14.40	0.004
ADL	95.59 ± 4.19	87.13 ± 14.40	0.004
Pain	95.59 ± 4.19	87.13 ± 14.40	0.004
Symptoms	95.59 ± 4.19	87.13 ± 14.40	0.004
Function	95.59 ± 4.19	87.13 ± 14.40	0.004

**Table 3. Postoperative comparison of IKDC and KOOS between AI brace and regular knee brace**

	Mean ± SD	Mean ± SD	P-value
IKDC			
ADL	87.84 ± 5.55	79.49 ± 9.11	0.003
Sport/Rec	87.84 ± 5.55	79.49 ± 9.11	0.003
QoL	87.84 ± 5.55	79.49 ± 9.11	0.003
KOOS			
ADL	95.59 ± 4.19	87.13 ± 14.40	0.004
Pain	95.59 ± 4.19	87.13 ± 14.40	0.004
Symptoms	95.59 ± 4.19	87.13 ± 14.40	0.004
Function	95.59 ± 4.19	87.13 ± 14.40	0.004

Figure 1: Study design flowchart. Recruitment, Inclusion, Randomization, Intervention (AI brace), Intervention (Regular knee brace), Assessment, Follow-up.

Figure 2: Bar chart showing IKDC and KOOS scores. The AI brace group (n=15) consistently shows higher scores than the regular knee brace group (n=15). Significance markers (\*\*\*) are present for all comparisons.

Figure 3: Bar chart showing IKDC and KOOS subscale scores. The AI brace group (n=15) shows significantly higher scores than the regular knee brace group (n=15) for all subscales except KOOS-ADL. Significance markers (\*\*\*) are present for most comparisons.

Table 1: Characteristics of preoperative patients. Age (years): 31, 31; Mean ± SD: 29.27 ± 9.19, 29.98 ± 9.20; P-value: 0.862.

Table 2: Postoperative comparison of IKDC and KOOS between AI brace and regular knee brace. IKDC Total: 87.84 ± 5.55, 79.49 ± 9.11; P-value: 0.003.

Table 3: Postoperative comparison of IKDC and KOOS between AI brace and regular knee brace. KOOS Total: 95.59 ± 4.19, 87.13 ± 14.40; P-value: 0.004.