



Correlation between Joint Stability and Knee Function According to Timing after Anterior Cruciate Ligament Reconstruction

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Dear Editor-in-Chief

The anterior cruciate ligament (ACL) is a key structure in the knee joint that resists anterior displacement and rotational instability of the tibia (1). However, many patients who have undergone ACL reconstruction do not recover to pre-injury levels due to decreased knee function such as muscle strength, stability, functional performance, and activity of daily living occur. Traditionally, clinical scores, joint stability, muscle strength, and functional performance are measured to recovery of the lower limb after ACL reconstruction (2). The effectiveness of rehabilitation and joint stability in patients with ACL reconstruction has been documented but association between joint stability, clinical scores, strength, and balance is limited.

Thus, we aimed to examine compare the difference and the correlations between joint laxity, clinical scores, strength, and balance at 6 and 12 months following ACL reconstruction.

Eighteen adult males (22.5 ± 2.5 years) diagnosed with complete rupture of ACL at Inje University Seoul Paik Hospital, Seoul, Korea, and underwent reconstruction by the same knee specialist were enrolled.

The inclusion criteria were as follows: (a) the pre-

injury activity level is a Tegner activity score of 5 or more, (b) single bundle ACL reconstruction using hamstring autograft, (c) six months of phased rehabilitation training following reconstruction, and (d) a retrospective study was conducted when the examination was performed at 6 and 12 months after reconstruction.

This study was approved by Institutional Review Board of Sungshin University (IRB NO: SSWUIRB-2020-047) and was conducted in accordance with the provisions of the Declaration of Helsinki.

Clinical scores such as Lysholm score, International Knee Documentation Committee (IKDC) subjective score, and Tegner activity score, knee anteroposterior laxity, isokinetic muscle strength, and balance were assessed at 6 and 12 months after ACL reconstruction.

Clinical scores are commonly used as an appropriate method to assess knee function after ACL reconstruction (3). The Lysholm score did not significantly change, but the IKDC ($P=0.006$) and Tegner activity scores ($P=0.013$) significantly improved. The KT-2000 arthrometer deficit (Med Metrics Corp. Inc., San Diego, CA, USA) result was 2.6 ± 1.7 mm at 6 months and 1.6 ± 1.3



mm at 12 months, showing a significant reduction of knee laxity as represented by the deficit between the uninvolved side and involved side ($P=0.020$) (Table 1). After 6 and 12 months of

ACL reconstruction, the stability assessment reflects that the knee anterior-posterior laxity results significantly reduced.

Table 1: 6 months and 12 months results (n=18)

Variable		6 months	12 months	P
Clinical scores	Lysholm score	90.4±5.7	93.8±5.6	0.164
	IKDC subjective score	83.4±13.1	95.4±4.8*	0.006*
	Tegner activity score	6.0±1.7	6.7±1.2*	0.013*
KT-2000 arthrometer deficit (mm)		2.6±1.7	1.6±1.3*	0.020*
60°/s	Extensor deficit	18.7±22.2	8.8±13.1*	0.016*
	Flexor deficit	10.6±15.2	7.1±10.9	0.446
180°/s	Extensor deficit	19.7±12.8	5.6±8.3*	0.000*
	Flexor deficit	8.7±12.8	1.8±10.9	0.112

IKDC, international knee documentation committee

*Statistically significant at $P<0.05$, tested by Wilcoxon signed-rank test

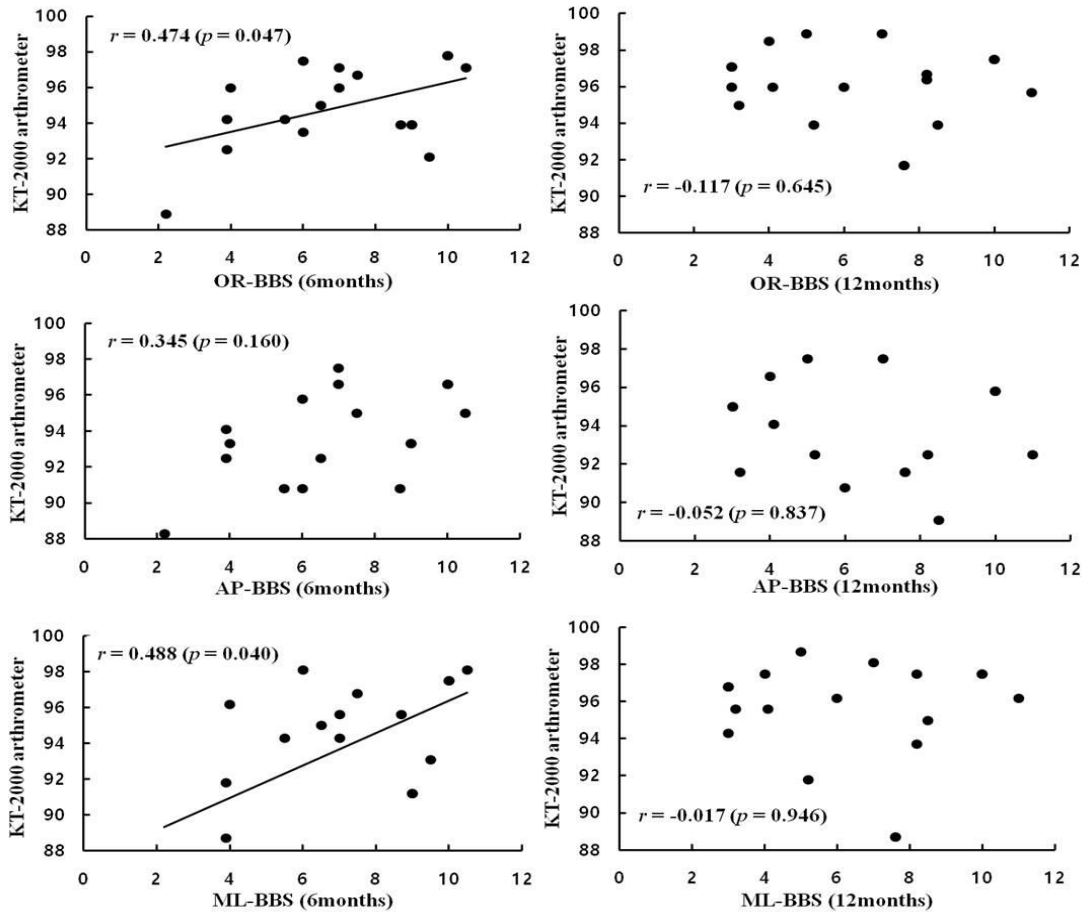


Fig. 1: Spearman correlation coefficient between knee laxity and balance on 6 months & 12 months OR, overall stability index; BBS, Biodex Balance System; AP, anterior-posterior stability index, ML, medial-lateral stability of index

The isokinetic muscle strength test is mainly used to evaluate knee function after ACL reconstruction (4). Regarding the differences in knee extensor and flexor strengths of the uninvolved side and involved side at 6 and 12 months, there were significant differences in the extensor strength deficit at 60°/s ($P=0.016$) and 180°/s ($P<0.001$) at 6 months; at 12 months, no flexor strength deficit was shown but extensor strength deficit significantly decreased at 12 months. Several studies have reported that after injury and reconstruction of the ACL recover normal strength of quadriceps is difficult and often not achieved (5,6).

There were no significant changes in the balance assessment in either period. In the correlation analysis between joint laxity using KT-2000 and various knee test results, there was a correlation in overall stability index of Biodex Balance System (BBS, Inc., Shirley, NY, USA) ($r=0.474$, $P=0.047$) and medial-lateral stability index of BBS ($r=0.488$, $P=0.040$) at 6 months, but there was no correlation at 12 months (Fig. 1).

The test results in this study show a significant correlation between knee laxity and balance assessment at 6 months after ACL reconstruction, which means that knee functions after 6 months indeed affect the patient's ability to keep balance. Thus, rehabilitation training focused on recovery of balance should be administered until 12 months after ACL reconstruction.

Acknowledgements

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Conflict of Interest

The authors declare that there is no conflict of interests.

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