Characteristics of Anterior Laxity of Hyperextension Knees in Healthy Young Females

[1]Weng-Hang Lai, [1]Chia-Ming Chang, [2]Horng-Chaung Hsu and [1]Hsiu-Chen Lin
[1]Department of Physical Therapy, China Medical University, Taichung, Taiwan (R.O.C.);
[2]Department of Orthopedics, China Medical University Hospital, Taichung, Taiwan (R.O.C.); Email: hclin@mail.cmu.edu.tw

INTRODUCTION

Anterior cruciate ligament (ACL) is one of the most frequent injured structures in sport participants. It is well-known that female athletes are more likely to sustain an ACL injury than male athletes. Previous study showed female individuals had larger anterior knee laxity than their male counterparts [1]. Knee laxity and hyperextension knee were reported a possible factor contributing ACL injury [2]. Loudon showed that a person with hyperextension knee, either healthy or ACL-injured, had poorer proprioceptive control. Even more, ACL-injured subjects with hyperextension knee demonstrated a declined function of proprioception feedback loop and the ability to initiate protective reflexes [3]. However, the relation between knee laxity and hyperextension knee was not clear. The aim of this study was to investigate the characteristics of knee laxity in healthy young female with hyperextension knee.

METHODS

Fifteen healthy young females with hyperextension knee and fifteen controls were recruited in this study. Hyperextension knee was defined if the knee extension was greater than 10°. Each subject was evaluated with KT-2000 knee ligament arthrometer (MedMetric Co., San Diego, CA) to obtain the anterior laxities of both knees at 30°and 90°of knee flexion. Three trials were collected for each condition. The force-displacement diagram of each trial was extracted and analyzed with a self-written MATLAB program (MathWorks, USA). The anterior tibial displacements with loadings of 10lb, 15lb, 20lb and 30lb were calculated. The displacement percentages of 10lb, 15lb, and 20lb relative to 30lb, maximum displacement in the trial, were also calculated. The stiffness of the ACL was evaluated with compliance indices, the differences of anterior displacements between loadings of 15lb to 30lb and 15lb to 20lb. Two-way mixed model ANOVA was used to understand the effects and interaction of limb (within-subject) and group (between-subject). Independent t-test and paired t-test were used as *post-hoc*. Statistically significant level is set at 0.05.

RESULTS

No significant difference was found in limb and group effect and their interaction at loading of 30lb. However, several statistical significances between limbs, groups and interaction with loadings of 15lb and 20lb were found, so we compare group and side effects separately. Compared between groups, the displacements at each testing angle showed no significant difference, but with a trend of larger displacement with 30lb in hyperextension group whereas a trend of smaller displacement with 10lb and 15lb (Fig. 1). Larger displacement percentages in the non-hyperextension group than those in hyperextension group were found in most conditions, especially in non-dominant side. Though compliance indices revealed no significant difference between groups in all conditions, hyperextension group has a trend of larger values than non-

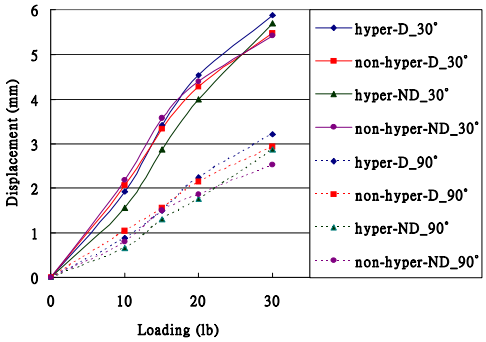

Fig. 1: The mean anterior displacements in both groups. (hyper: hyperextension group, D: dominant side, ND: non-dominant side)

hyperextension group at knee flexion 30°. As to limb effect, in hyperextension group, dominant side had significant larger displacements except with 30lb loading conditions and 15lb in 90° condition (Fig.2). Larger displacement percentages in dominant side were also found in 15lb and 20lb of 30° condition. In non-hyperextension group, there is no side difference both in anterior displacements and percentages.

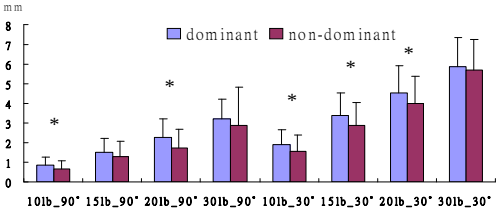

Fig. 2: The anterior displacement between dominant side and non-dominant side in hyperextension group. (＊ indicates significant difference)

DISCUSSION AND CONCLUSIONS

With similar maximal displacement, hyperextension group tended to have larger laxity during terminal loading while non-hyperextension group have larger laxity during initial loading. The dominant side of hyperextension group had even larger displacements than the others. The larger laxity in higher loading condition in the hyperextension group could result in higher risk of ACL injury.

REFERENCES

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2. Ramesh R, et al. *J Bone Joint Surg Br*,87-6:800-3, 2005.