Comparison of Proximal Tibiofibular Joint Detachment and Tibial-sided Osteotomy for Fibular Untethering in Lateral Closing-Wedge High Tibial Osteotomy: A Cadaveric Study

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INTRODUCTION:
Proximal tibiofibular joint detachment (PTFJD) is one of fibular untethering procedures during lateral closing-wedge high tibial osteotomy (LCWHTO) for varus knee osteoarthritis. However, the PTFJD procedure is technically demanding and the confirmation of clear joint separation is not straightforward. The aim of this study is to compare the degree of completion and safety of the procedures between PTFJD and tibial-sided osteotomy (TSO), which is our novel technique for fibular untethering during LCWHTO.
METHODS:
Sixteen fresh frozen cadaver knees from 8 cadavers were included in the study. Among the 8 pairs of knees, one knee was randomly assigned to PTFJD and the other knee was assigned to TSO, which separates fibula by osteotomizing the lateral cortex of proximal tibia at the medial side of proximal tibiofibular joint (PTFJ) for fibular untethering during LCWHTO. After each procedure with LCWHTO, posterior compartment of each knee was dissected to compare the degree of procedural completion and the distance from posterior detachment or osteotomy site to posterior neurovascular structures between PTFJD and TSO groups. The pass-through test crossing the separation site from anterior to posterior using an osteotome was also performed to confirm the protective effect of the muscular structures of the posterior compartment.
RESULTS:
In PTFJD group, 4 out of 8 cases (50%) showed fibular head fractures instead of division of the PTFJ. In contrast, all TSO cases showed clearly osteotomized lateral cortex of the proximal tibia from the medial side of the posterior PTFJ. The distances from the posterior detachment or osteotomy site to the common peroneal nerve, popliteal artery, and anterior tibial artery in PTFJD and TSO groups were measured as 20.8 ± 3.3 mm and 22.9 ± 3.6 mm (p = 0.382), 11.0 ± 2.4 mm and 9.8 ± 2.8 mm (p =0.382), and 14.8 ± 1.9 mm and 14.9 ± 2.5 mm (p = 0.721), respectively. In the pass-through test, a osteotome was pass through from anterior to posteriorly in all 8 cases of PTFJD group, But the osteotome was blocked posteriorly by the popliteus muscle in all cases of TSO group, which could protect posterior neurovascular structures during the procedure.
DISCUSSION AND CONCLUSION: The TSO, a novel fibular untethering procedure for LCWHTO, showed clear separation from lateral tibial cortex, safer distance from around neurovascular structures than PTFJD, while being protected by the popliteus muscle during procedure. Our novel surgical technique is anticipated to provide more clear-cut and safer fibular untethering for LCWHTO.

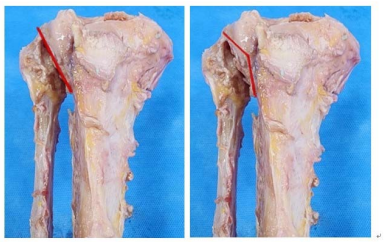

Fig 1. Proximal Tibiofibular Joint Detachment (A) and Tibial-sided Osteotomy (B)

Fig 2. The protection shielding effect of popliteus muscle following tibial-sided osteotomy

Table 1. Distances to posterolateral neurovascular structures from posterior detachment or osteotomy site after PTFJD and TSO.

	PTFJ detachment (n=8)	Tibia-sided osteotomy (n=8)	P-value
Distance to common peroneal nerve (mm)	20.8 ± 3.3	22.9 ± 3.6	0.382
Distance to popliteus artery (mm)	11.0 ± 2.4	9.8 ± 2.8	0.382
Distance to anterior tibial artery (mm)	14.8 ± 1.9	14.9 ± 2.5	0.721

PTFJD, Proximal tibiofibular joint detachment; PTFJ, Proximal tibiofibular joint; PTFL, Proximal tibiofibular ligament; TSO, Tibial-sided osteotomy.