The Acute Oblique Osteotomy and Ligation Procedure to Shorten the Fibula in High tibial Osteotomy: Clinical Evaluations of the Safety and the Union Rate

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INTRODUCTION:

Lateral closing-wedge high tibial osteotomy (LCW-HTO) is a useful surgical option for medial osteoarthritic knees with severe varus deformity. However, one of the disadvantages of the LCW-HTO is that fibular osteotomy must be performed to shorten its length. Although many fibular osteotomy procedures have been developed, various complications have been reported, including peroneal nerve palsy and non-union at the fibular osteotomy site. To eliminate these complications, we recently developed a simple fibular osteotomy (AO/L) procedure, which was composed by an acute oblique osteotomy and a ligation technique, based on the previously developed acute oblique osteotomy (AO) procedure. A purpose of the present study is to evaluate the 2-year follow-up results of the AO/L procedure, compared with those of the AO procedure.

METHODS: A prospective comparative cohort study was conducted, involving a total of 83 knees of 83 patients who underwent shortening osteotomy of the fibula in LCW-HTO. The first consecutive 41 knees underwent fibular osteotomy with the AO procedure (AO group). The remaining 42 knees underwent fibular osteotomy with the AO/L procedure (AO/L group). In the AO procedure, fibular osteotomy was made at the center point of the shaft on the quasi-frontal plane, which was inclined by 25–30 degrees to the long axis of the fibula. In the AO/L procedure, the fibular osteotomy technique was the same as the AO procedure. Immediately before completing the osteotomy, 2 holes were created in the lateral cortices of the two fibular fragments, and then, a No. 2 polyester thread was passed through the 2 holes (Figure 1). After completion of the HTO, the displaced ends of the osteotomized fibula were reduced, and the polyester thread was securely tied. All the patients were followed up for 2 years or more after surgery, and then underwent clinical and radiological evaluations. Namely, the following variables were compared between the AO and AO/L groups. (1) Perioperative complications were collected from the medical record. (2) The period needed for complete union at the fibular osteotomy site was determined by evaluating the radiographs taken after surgery using the modified RUST (radiological union score for tibia fracture) score by three experienced orthopaedic surgeons. (3) On the plain radiographs taken immediately after surgery, the shortest distance between the separated bone ends at the osteotomy site was measured. (4) Clinical symptoms at the osteotomy site were examined at 24 months after surgery. Quadratic weighted Kappa was used to assess inter- and intra-rater reliabilities concerning the radiographic union score. Comparisons on the radiological parameters between the 2 groups were performed using the Student t-test for continuous variables and Mann-Whitney U test or the Fisher Exact test for discrete variables. The significance level was set at $P=0.05$.

RESULTS: There were no significant differences in the preoperative factors between the groups. No perioperative complications were found around the fibular osteotomy site in either group. Regarding the inter-rater and intra-rater reliability of the modified RUST, the weighted Kappa was 0.814 to 0.862 and 0.977. The radiological union score of the modified RUST was significantly greater in the AO/L group than in the AO group ($P<0.0001$ at 2, 3, and 6 months; $P=0.0290$ at 12 and 24 months) (Figure 2). The union rate at the fibular osteotomy site was significantly higher in the AO/L group (97.6%) than that in the AO group (82.9%) at 12 months ($P=0.0290$). The mean distance between the osteotomized fibular ends in the AO/L group (0.4 mm ± 0.1) was significantly less ($P<0.0001$) than that in the AO group (3.6 mm ± 2.3). The initial distance between the osteotomized fibular ends in the 7 knees in the AO group (6.0 mm ± 1.5), which became non-union, was significantly greater ($P=0.0003$) than that in the remaining 34 knees (3.1 mm ± 2.1), which had bone union. A significant correlation ($R=0.7987$, $P<0.0001$) was found between the initial separation distance and the period needed for the bone union at the osteotomy site. Five patients in the AO group complained of lateral leg pain during walking and tenderness at the fibular osteotomy site, while only one patient in the AO/L group complained of these symptoms. All 6 of these patients had non-union at the fibular osteotomy site. Patients who had bone union at the fibular osteotomy site did not complain of lateral leg pain.

DISCUSSION AND CONCLUSION:

The AO/L procedure significantly accelerated bridging callus formation at the fibular osteotomy site and provided a significantly higher union rate, compared with the AO procedure. It is considered that the high union rate in the AO/L group was caused by the contact between the two osteotomized fibular ends. In addition, both AO/L and AO procedures were safe from peri-operative complications. The AO/L procedure is clinically beneficial to minimize incidence of the postoperative lateral leg pain. The AO/L procedure does not need any additional cost, except for a non-absorbable thread. There are some limitations in this study. First, the present study was not a randomized comparative trial. Secondly, the ease of this procedure has not been quantified, although this procedure is obviously simple. Third, the clinical results of

the performed HTO have not been evaluated. Beyond these limitations, this study present that the AO/L procedure is clinically safe and useful as an osteotomy procedure to shorten the fibula in LCW-HTO.

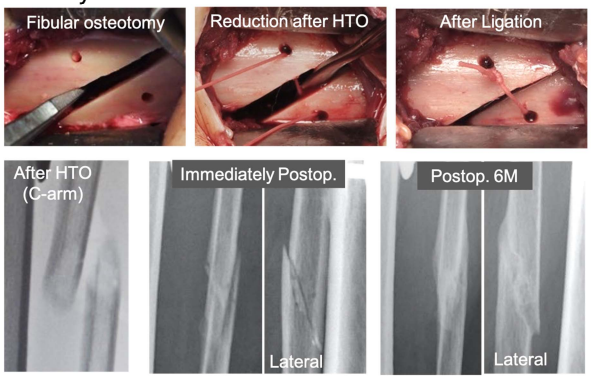

Figure 1.

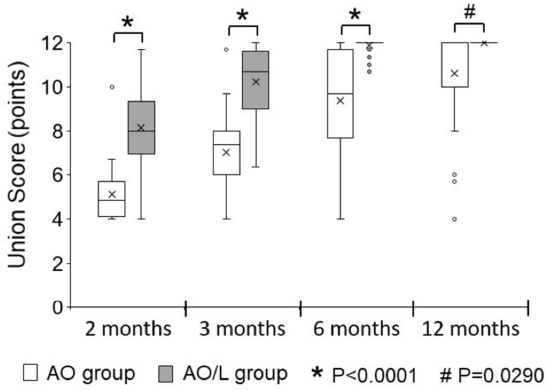

Figure 2.