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Effects of Autologous Osteophyte Grafting for Open-Wedge High Tibial Osteotomy with Beta-Tricalcium Phosphate Spacers

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Summary:

An autologous osteophyte grafting was significantly superior to a non-grafting, concerning the gap filling rate after medial open-wedge high tibial osteotomy with wedged beta- tricalcium phosphate spacers.

Abstract:

Introduction

Recently, the medial open-wedge (OW) high tibial osteotomy (HTO) with a locking plate has attracted a great deal of attention. However, OWHTO has the disadvantage that a large vacant space is left in the proximal tibia after surgery.

Osteophytes are physiological bony outgrowths that develop at the margins of the articular surfaces during the progression of osteoarthritis; they are associated with active endochondral bone formation processes and expressions of various growth factors. Recently, Akiyama et al (Arthrosc Tech 2016) have been using osteophyte autografts for osteotomy gaps in OWHTO with positive preliminary results indicating rapid bone healing of osteotomy sites. The purpose of this study was to clinically and radiologically compare the gap filling rate of osteophyte grafting and non-grafting in OWHTO.

Methods

A prospective comparative cohort study was conducted with forty-five consecutive patients (50 knees) who underwent OWHTO with a locking plate between 2013 and 2016. There were 14 men and 31 women with a mean age of 61 (36-84) years at time of the surgery. All the patients were randomly divided into the two groups. In Group N (25 knees), only the wedged beta-tricalcium phosphate (TCP) spacer (OSferion 60, Olympus Terumo Biomaterials) was implanted in the opening space. In Group O (25 knees), osteophytes harvested by arthroscopy and beta-TCP spacer were implanted in the same manner. Osteophytes were harvested by the chisel from femoral intercondylar notch and medial condyle. All patients underwent clinical and radiological examinations at 2 years after surgery. This study design had been accepted by the institutional review board clearance in our hospital. To evaluate bone union, the osteotomized gap area of the coronal plane was divided into five zones according to Brosset et al (OTSR 2011).

Gap filling was defined that mature trabecular continuity was observed in Zone 3 using a computed tomography.

Statistics analyses were made using Mann Whitney-U test. Significant level was set at $p=0.05$.

Results

There were no significant differences in the all background factors between the 2 groups. Postoperatively, the

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functional knee score (Japanese Orthopaedic Association score) significantly improved to 82 points and 84 points in Groups O and N, respectively. Postoperatively, the mean lateral anatomical femorotibial angle changed to 169° in the both groups, respectively. The weight-bearing line percentage shifted to pass through a point 63% and 65% lateral from the medial edge of tibial plateau in Groups O and N, respectively. Regarding the postoperative clinical outcome and knee alignment, there was no statistical difference in each parameter between the two groups. The gap filling rate of the Group O (mean, 12 weeks) was significantly faster ($p<0.001$) than that of the Group N (mean, 18 weeks) in Zone 3.

Discussion

Concerning the bone union, several authors reported 12 to 20 weeks in non-grafting cases after OWHTO. However, Akiyama reported bone healing was observed at 5 weeks postoperatively on average. In present study, the osteophyte grafting was significantly faster than the non-grafting. These results suggested that autologous osteophyte grafting can be a useful method for accelerating bone union and therefore enabling weight bearing from an early stage after surgery, which will lead to an early return to social activities. This technique would be advantageous in shortening the bone-healing period and improving range of motion, especially increasing extension.