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Surgical technique

Total knee arthroplasty for treatment of osteoarthritis associated with extra-articular deformity

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ABSTRACT

Objective: Our purpose was to review senior author results of TKA in patients with extra-articular angular deformities (correction of mechanical axis was performed without an additional procedure for osteotomy).
Methods: Results of TKA in nine knees with osteoarthritis and associated extra-articular angular deformity of femur were reviewed retrospectively. This group was compare with a with a control group of 20 patients diagnosed with osteoarthritis that underwent TKA without extra-articular deformity. Angulation of deformity in patients was 19° in coronal plane (range 15°–25°) and 12° in sagittal plane (range 8°–5°). Knee Score (KS) and Functional Score (FS) were measured pre and post-surgery, likewise arc flexion was reported. Results in KS and FS were correlationed with extra-articular angulation.
Results: Duration of follow-up averaged 55 months (range, 48–63 months). KS Average and FS increased from 50.5 and 38.4 points, preoperatively, to 96.5 and 84.4 points, respectively, at time of following-up. No statistically significant differences in any postoperative parameters were found between the postoperative group of extra-articular deformities and the control group were found. Positive correlation was obtained between deformity degrees and KS. Arc of motion averaged 86° preoperatively and 118° at time of following-up. No total knee arthroplasty was revised.
Conclusion: In our opinion, best management for extra-articular deformities associated to osteoarthritis is to carry out a knee replacement without corrective osteotomy on condition that planification allow to us avoid ligaments insertions, using an extensive soft-tissue balancing in conjunction with a minimally constrained TKA.

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1. Introduction

Extra-articular deformities of femoral or tibial axis increase stresses through knee and may eventually cause osteoarthritis, this pathology is frequently treated with a total knee replacement.[1] Such deformity may be secondary to metabolic bone disease, Paget disease, a malunited fracture, or a previous osteotomy. Corrective osteotomy and total knee arthroplasty, carried out in one or two stages, as a method to achieve normal alignment of long bones and better ligament balancing when a patient has an arthritic knee with extra-articular deformity.[2] However, this technique may be associated with substantial complications, including nonunion at osteotomy site, infection and arthrofibrosis. An alternative to combined osteotomy and total knee arthroplasty (TKA) approach is to perform intra-articular bone resection and soft-tissue balancing, without osteotomy. This procedure may be appropriate when insertion of collateral ligaments of knee are not be jeopardized by intra-articular bone resection. Extensive soft-tissue balancing in conjunction with a minimally constrained total knee prosthesis has been described for management of severe varus and valgus deformity, like described Insall,[3,4] and only for valgus deformity of knee following high tibial osteotomy, like described Krackow.[5] Residual misalignment after TKA may result in inferior results cosmetically, functionally, and in long term. For this reason is very important to plan surgery to obtain a successful result (2). We report our experience with use of TKA for treatment of eight patients with osteoarthritis of knee associated to extra-articular deformity, through bone resection intra-articular, without corrective osteotomy.

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2. Methods

2.1. Patients

A total of 3200 patients undergoing TKA from 1990 to 2015 were assessed retrospectively. One surgeon performed every surgery. In this time nine great extra-articular deformities in femur (>15°) were operated in one-stage with total knee arthoplasty, that were managed adequately by modified intra-articular bone resection and ligament balancing with no need for an additional osteotomy. All patients were candidates for TKA surgery, with main etiology being osteoarthritis secondary to femoral deformities. Six femur had a uniplanar deformity (four varus and one valgus) and three had a biplanar deformity (three varus + recurvatum and one varus + antecurvatum). Angulation of deformity in eight patients was 19° in coronal plane (range 15°–25°) and 12° in sagittal plane (range 8°–5°). There were seven men and two women with an average age of seventy-three old (range 61–85) We compare this cohort with a control group of 20 patients diagnosed with osteoarthritis that underwent TKA without extra-articular deformity (Table 1).

Femoral deformity resulted from fracture malunion in six patients and secondary to femoral osteotomy in three cases. Preoperative radiographs were used for planning bone resection, designing on paper cuts. Distal femoral resection was made perpendicular to mechanical axis of femur. Theoretical intra-articular resection of femoral bone was determined on same radiographs, with a plan for a 90° osteotomy was considered necessary if, on full-length weight-bearing radiograph, it appeared that distal femoral bone resection at a right angle to mechanical axis could compromise integrity of insertion of either medial or lateral collateral ligament. A CT scan was made for each case in patella's cuts, in this way femoral rotation could be calculated in relation with transepicondylar line and used to carry out anterior and posterior resections.

2.2. Surgical technique

Standard medial parapatellar approach was released in all cases. Intramedullary guide was used to cut femoral condyles, associated to extramedullar checking. Point of drilling was placed on lateral femoral condyle for varus deformities and on medial femoral condyle for valgus deformity. In order to achieve a normal mechanical axis in limb with a varus deformity, more lateral condyle than medial condyle have to be removed from distal part of femur or proximal part of tibia. Soft-tissue balancing after bone resection was an important part of this procedure in all cases This resulted in relative lengthening of lateral soft-tissue structures Extramedullary guide was used for tibial cut, with posterior slope of 7°. Bone resected from lateral or medial aspect of tibia was limited to 10 mm. Therefore, extensive release of medial soft-tissue complex was required, and technique described by Insall.[3] This procedure includes meticulous subperiosteal release of medial collateral ligament and anserinus tendons from their tibial insertions. With valgus deformities, more medial condyle than lareral condyle would have to be removed from distal part of femur or proximal part of tibia, after multiple horizontal stab incisions were made through ilio-tibial band (ITB) and lateral capsule until medial-lateral soft tissue balance was achieved, using "pie crusty" technique.[6] In all cases, patellar replacement was released after of bone milled.

Type of prosthesis selected for extra-articular deformities cases were generally posterior stabilized (PS), seven cases received Nex-Gen 2 (Zimmer) and one case received Insall Burstein II (Zimmer), while for control group every cases were performed with PS Nex-Gen 2 (Zimmer). Tourniquet was used in all interventions, and was released after suture.

Clinical and functional evaluations were carried out comparing preoperative and postoperative objective scores according to system of Knee Society.[7] This scale includes a 100-ponts Knee Score (KS) for evaluation of such categories as pain, range of motion, and stability, with deductions for flexion contracture, extension lag, instability, and malalignment. It also assigns a maximum of 100 points for functional capacity, Functional Score (FS), which includes such parameters as ability to walk on level ground and on stairs as well as necessity for assistive devices. Alignment shaft was checked with alignment rod. Angular deformity of mechanical axis of femur was determined preoperatively on weight-bearing full-length radiographs that incorporated ipsilateral hip and ankle (Figs. 1–8). Alignments of femoral and tibial components were measured on initial postoperative anteroposterior and lateral radiographs, in addition radiographs were made to determine presence of interface radiolucencies and to document any progression.

2.3. Statistical analisys

Data was analysed with Statistical Package for Social Science software (SPSS 22.0). To test whether administered surgery had an effect over treated disease, we conducted an Analysis of Covariance for repeated measures (AnovaRM), with Time (Pre, Post1, Post2, and Post3) as within-subject factor. We performed two separate AnovaRM for Knee Score and Function Score, respectively. Furthermore, to control for a potential effect of level of knee deformity previous surgery over treatment effect, we performed two separate Analysis of Covariance for Repeated Measures (AncovaRM) for Knee Score, and Function Score, respectively, with Time as within-subject factor (Pre, Post1, Post2, and Post3), and degree of extra-articular deformities covariate. Greenhouse-Geisser corrections were used when data violated assumption of sphericity. We conducted post-hoc comparisons with Bonferroni

Table 1
Patients data.

N° Patient	Age	Sex	Diag. preop.	Deformity preop (degrees)	Type of TKA
1	64	Man	Distal femoral osteotomy	20 varus, 12 recurvatum	Nex-Gen
2 (Figs. 3 and 4)	61	Woman	Distal femoral fracture	24 varus, 10 antecurvatum	Nex-Gen
3	63	Man	Distal femoral osteotomy	17 valgus	Nex-Gen
4 (Figs. 5 and 6)	83	Man	Distal femoral osteotomy	16 varus	Nex-Gen
5	73	Man	Distal femoral fracture	15 varus	Nex-Gen
6 (Figs. 7 and 8)	79	Woman	Distal femoral fractura	15 varus	Nex-Gen
7	78	Man	Distal femoral fracture	21 varus	Nex-Gen
8 (Figs. 1 and 2)	73	Man	Proximal femoral fracture	25 varus, 15 recurvatum	Insall
9	64	Man	Distal femoral fracture	25 varus, 12 recurvatum	Nex-Gen

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