

The Management of Extensive Bone Loss in Primary and Revision Total Knee Replacement

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Summary

Introduction. Total knee replacement (TKR) is still a challenging procedure for severe gonarthrosis patients. Deformities of knee joint (varus, valgus – more than 30 degrees), insufficiency of collateral ligaments and extensive bone loss could be a difficult problem to solve with standard knee endoprosthesis. Also in cases of revision - TKR the restoration of bone loss and regaining of stability of the joint could be a problem.

Aim of the Study. The aim of our study was to analyse the results with Rotating - Hinge prosthesis after severe primary and revision TKR.

Materials and Methods. 34 patients (27 female, 7 male) were treated with Rotating – Hinge prosthesis during 12 years (first in 1997). Mean age of patients were 69 years. 17 operations were primary total knee arthroplasties and also 17 were revisions of the knee prosthesis. The Oxford Knee score was used for evaluation of patients satisfaction rate. The Knee Society Score was used to get objective functional results. For radiological analysis X-rays of knee joint in two projections were performed.

Results. 34 Oxford Knee score questionnaires were sent to patients, response we got from 27 patients (79%). Mean result from Oxford Knee score was 32 which is good. The same number of patients (34) were invited for examination using Knee Society score. The response were from 20 patients (59%). Mean result from Knee Society score was 83, which means excellent.

Conclusions. Rotating-Hinge prosthesis allows to achieve good and excellent functional results and high patients satisfaction rate after severe primary and revision TKR. The biological age, general health condition, insufficiency of ligaments and previous infection in patients history have to be considered for choosing the tactics for each case.

Key words: severe gonarthrosis, Rotating-Hinge endoprosthesis, semi-constraint.

INTRODUCTION

TKR is one of the most successful operation in the treatment of gonarthrosis. In spite of that there are conditions when TKR becomes a challenging procedure. These conditions are severe deformities of knee joint (varus, valgus – more than 30 degrees), insufficiency of collateral ligaments and extensive bone loss. Also in cases of revision - TKR the restoration of bone loss and regaining of stability of the joint could be a problem. Orthopaedic surgeon has a possibility to use standard (non-constraint) endoprotheses and grafting with auto- or allo-bone (to fill the bone defects). For better fixation into the bone endoprotheses with longer stems are available. In cases of severe ligament insufficiency semiconstraint or fully constraint implants could be a solution. In the Riga Hospital of Traumatology and Orthopaedics we used Rotating Hinge (Endo Model) endoprotheses produced by W.Link company (Germany) for the treatment of very severe primary and revision cases.

The Rotating Knee Prosthesis allows axial rotation and reduces the forces acting on the prosthesis anchorage. The prosthesis is semi – constrained, long stemmed, cemented and the material of the prosthesis is made of Co-Cr alloy. Retaining the low friction principle, the physiological movement of the Rotational Knee Prosthesis is optimal because the pivot point is within the physiological area (1; 3-7; 10).

From our point of view the indications to use Rotating Hinge endoprosthesis are - severe deformities of the knee joint as Varus or valgus > 30°, severe insufficiency of collateral ligaments, severe bone loss (especially for patients with low potential for bone healing), insufficiency of muscles (Figure 1).

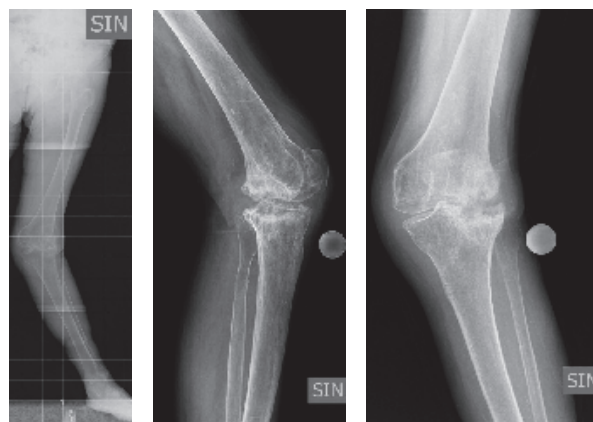


Fig. 1. Patient with severe gonarthrosis, valgus deformity.

AIM OF THE STUDY

The aim of our study was to analyse the results with Rotating - Hinge prosthesis after severe primary and revision TKR.

MATERIALS AND METHODS

34 patients (27 female, 7 male) were treated with Rotating - Hinge prosthesis during 12 years (first in 1997). Mean age of patients were 69 years. The youngest patient was 45 years old, but oldest – 84 years old. From year 2005 till 2009 32 patients were operated, but in years 1997 and 2003 one patient in each year were operated. 17 operations were primary total knee arthroplasties and also 17 were revisions of the knee prosthesis.

The Oxford Knee score was used for evaluation of patients satisfaction rate. The Knee Society Score was used to get objective functional results. For radiological analysis X-rays of knee joint in two projections were performed.

RESULTS

34 Oxford Knee score questionnaires were sent to patients, but response we got from 27 patients (79%). Mean result from Oxford Knee score was 32 which is good. 4 were poor, 3 – fair, 13 – good and 7 patients had excellent result (Figure 2). The same number of patients (34) were invited for examination using Knee Society score. The response were from 20 patients (59%). Mean result from Knee Society score was 83, which means excellent. 1 patient had poor result, 2 – fair, 2 – good and 15 had excellent result (Figure 3).

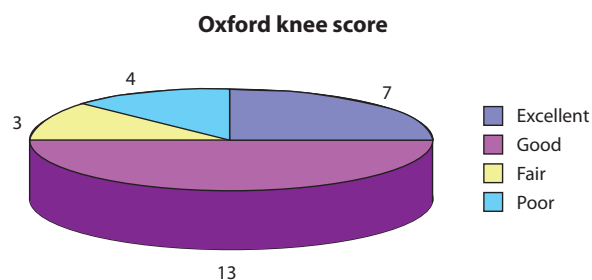


Fig. 2. The results of Oxford Knee score.

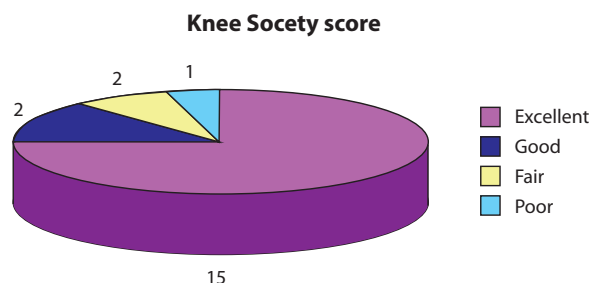


Fig. 3. The results of Knee Society score.

There were also 5 complications. 2 deep infections (one - treated by two step revision operation; second - due to critical general condition - amputation), 1 - fracture of patella (3 months after operation – due to severe osteoporosis), 1 - rotational malposition of femoral component and 1 periprosthetic fracture of femur (6 months after operation, healed without surgical treatment).

DISCUSSION

Comparing Oxford Knee Score and Knee Society Score results, we saw that functional outcome was better than patients' satisfaction rate (Figure 4). Our opinion is that Oxford Knee Score results are not always objective because they depend also on the influence of sickness of other joints, side diseases and etc.

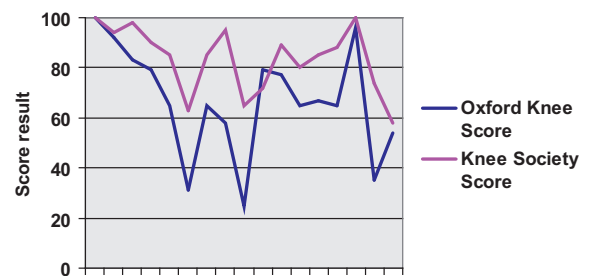


Fig. 4. Comparison of Oxford Knee Score and Knee Society Score results.

In the treatment of severe gonarthrosis and difficult revision cases we have to deal with three major problems:

1. Bone defects, mostly segmental.
2. Malalignment
3. Instability due to insufficiency of knee ligaments

There are two common tactics to manage these problems:

1. Using bone allografts together with non-constraint implants with long cementless stems (cementing only metaphyseal parts of implants);
2. Totally cemented long stem implants with rotating-hinge articular junction.

Some authors (9) propose to perform bone grafting with structural allografts to reconstruct the bone defects and restore the joint line. Some of them (9) prefer to use trabecular metal augments. Bone grafting for younger patients with high potential of bone regeneration could be the best choice, but in elder patient group we could deal with graft resorption and secondary loosening of implant.

The trabecular metal augments seems to be a solution in those cases, but the huge expenses and absence of long term results let us be precautious in the wider use of this. Our study results show that use of bone cement

even for the substituting of segmental bone defects with additional screw augmentation in older patient group could satisfactory solve the bone defect problem.

To correct a malalignment the authors (8) propose the careful balancing of the flexion and extension gaps with several steps of ligament releases. In severe cases the ligaments are absent or hard damaged that even after release the proper balancing and stable joint is not possible to achieve.

By applying the R-H the dissection of the collateral ligaments leads to the balance in the joint avoiding the asymmetric stress forces on the joint surfaces. The coupling mechanism of rotating hinge reduces the rotational stress forces on the stem–bone, cement–bone interfaces. The so called less constraint implants have about 1° possible rotation between the intercondylar space and polyethylene cam (2). That can lead to the loosening of the stem even if the bone cement fixation is used in methaphyseal segment. In our study we have not faced with aseptic stem loosening with R-H prosthesis.

The use of long stemmed non-constrained implants is definitely useful to heal large bone defects in cases of severe osteoarthritis. From our point of view this method is useful for younger patients. The bone healing potential for older ones is low. The reason why we prefer R-H is that even in very severe cases after TKR with R-H we get stable and moving knee and possibility of partial or full weight – bearing from the second day after operation.

CONCLUSIONS

Rotating-Hinge prosthesis allows to achieve good and excellent functional results and high patients satisfaction rate after severe primary and revision TKR. The biological age, general health condition, insufficiency of ligaments and previous infection in patients history have to be considered for choosing the tactics for each case.

Conflict of interest: None

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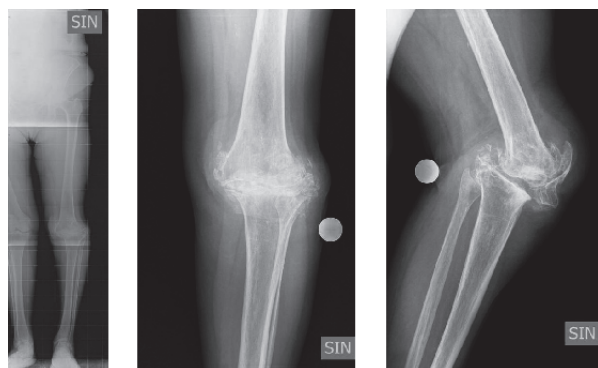
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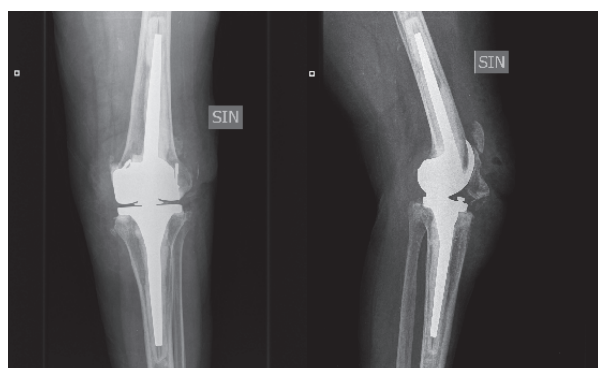
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CLINICAL EXAMPLES

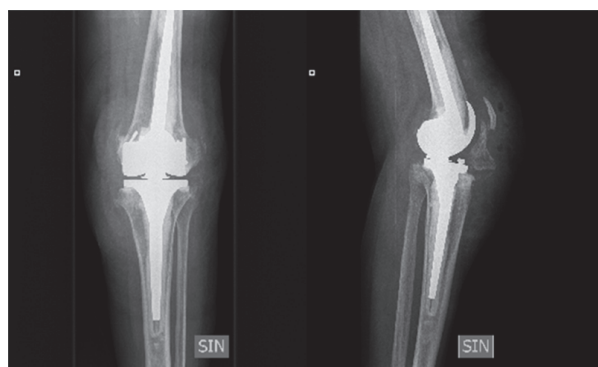
I. Patient S.K. (female, 72 y.o.)



Severe gonarthrosis due to septic arthritis 30 y. ago. Lack of active extension - 60°. (Extensor mechanism damaged during forced flexion of knee 30 y. ago).

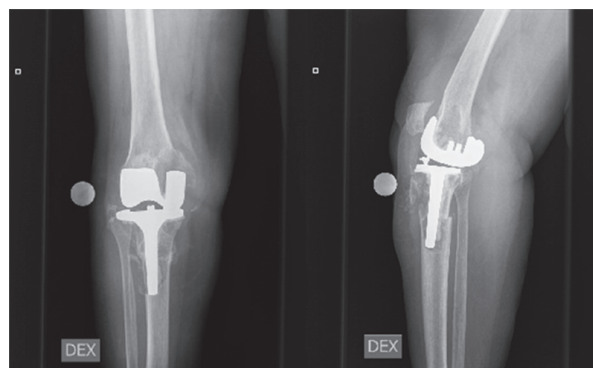


Primary TKR by Rotating-Hinge (Knee was stable, but not full active extension possible).

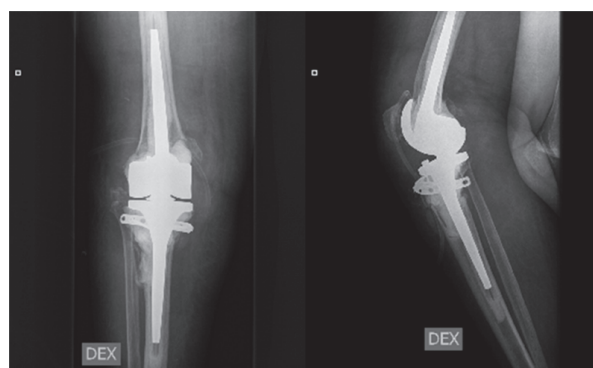


3 months after primary TKR musculus rectus femoris V-type reconstruction made

II. Patient J.A. (female, 83 y.o.)



Aseptic loosening of both components and periprosthetic fracture of femur and tibia (12 years after primary TKR)



1 stage revision TKR with Rotating-Hinge



Functional result