Combination of Osteotomy with Autologous Chondrocyte Implantation for treatment of early Osteoarthritis of Knee

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Introduction

Knee arthroplasty is the end-stage procedure for biological joint failures. Surgically correcting underlying knee misalignments and promoting cartilage regeneration can delay such joint replacements in young patients. The aim of this study is to assess functional outcomes and survivorship of combining Osteotomy with Autologous Chondrocyte Implantation (ACI) for treatment of articular cartilage defects in early Osteoarthritis (OA) of knee.

Methods

Data was prospectively collected for functional outcomes and survivorship of combined osteotomy and ACI for chondral defects in early OA for 18 consecutive patients - 12 males, 6 females, aged 16 - 65 years (mean age 38.8 years) over a mean follow up period of 45.1 months. Of the total number of patients, 14 patients had associated meniscal pathology, with 4 requiring previous operative treatment. All patients had signed an informed consent prior to the planned treatment. Patients were followed up after they underwent both ACI and osteotomy - 14 patients had osteotomy and ACI done simultaneously, 4 patients had two procedures at an average interval of 9 months (time range 5-16 months). 7 patients had distal femoral varus osteotomy - 1 medial closing wedge and 6 lateral opening wedge osteotomies. 11 patients had proximal tibial osteotomies - 1 closing varus osteotomy, 1 closing valgus osteotomy and 9 had opening valgus osteotomies. Opening wedge osteotomies were done by Tensegrity technique. Lysholm scores, collected annually, were compared with pre-operative scores. Knee arthroplasty / pending knee replacements were considered failure of the existing treatment and defined as end of follow-up. A Kaplan-Meir curve was used to ascertain the survival probability at 5 and 10 years. Arthroscopy of the knee done 3 weeks prior to the ACI confirmed chondral defect size, site and allowed simultaneous cartilage biopsy from non-weight bearing areas to harvest chondrocytes. These chondrocytes were released by enzymatic digestion and expanded in vitro in Good Manufacturing Practice (GMP) standard laboratory of the hospital. On an average, 1.1 million cells per cm² of chondral defect were re-implanted at 21 days. Chondroguide (14 patients) and periosteal patch (4 patients) were used to contain these cells on the defects.

Results

The 5 and 10- year cumulative survival probability of combined procedures were 84.8 per cent and 72.8 per cent respectively, with 3 failed treatments. Mean pre-operative Lysholm score was 42.7 (SD 16.3), improving by 17.1 points (SD-23.3) to 59.8 (SD 27.1) at the last follow up. Oldham’s method showed significant rise in post-operative Lysholm scores. The mean chondral defect size was 10.9 cm² (SD-9.3 cm²) with 13 patients having interface chondral defects between Tibia and femur. Student’s T-test was used to ascertain the influence of meniscal pathology, interface chondral defects and location of osteotomy on the outcome following such procedures. Patients with co-existent meniscal pathology (n=14) or interface chondral defects (n=13) between femur and tibia had significantly less improvement of Lysholm scores at follow up (p-value < 0.05). Tibial osteotomies (n=14) had better outcomes than femoral osteotomies (n=4) (p-value <0.05).

Conclusion

Combining ACI and Osteotomy can delay joint replacements in young patients with large chondral defects for a period up to ten years. Improvement of post operative Lysholm scores through this method is comparable to outcomes of ACI for treatment of smaller chondral defects. Concurrent meniscal pathology or interface lesions between tibia and femur can impair the outcome following such procedures. Tibial osteotomies done to correct the alignment produce favourable outcome than femoral osteotomies. This study is restricted by a relatively small sample size, with a single surgeon recruiting patients in one tertiary care centre. Nevertheless, it ensures the uniformity of the surgical intervention and hence avoids discrepancies in outcome.

Significance

Simultaneous correction of the axis of a joint and re-instating the biology of denuded cartilage by ACI can pave way to modern techniques of treating OA in young. This can not only prolong requirement for primary joint replacements but can markedly reduce the revision joint replacement surgery in addition to its associated complications.