BONE PLUG-AUTOLOGOUS CHONDROCYTE IMPLANTATION (BP-ACI)
A NOVEL SURGICAL TECHNIQUE FOR TREATING OSTEOCHONDRAL DEFECTS

++ Gupta, A; *Bhosale,A;* Harrison,P; *Davies J, *Ashton, B ; *Richardson, J B
+*Institute of Orthopaedics, Robert Jones Agnes Hunt Orthopaedic Hospital, Oswestry,United Kingdom
ajaygupta@hotmail.co.uk

Introduction

Due to increased participation of young people in contact sports, the incidence of chondral and osteochondral injuries is increasing as are the challenges faced by tissue engineers and orthopaedic surgeons in managing such injuries. Autologous Chondrocyte Implantation has revolutionised the treatment of chondral and osteochondral injuries. However it is not suitable for large osteochondral defects. The Osteochondral grafting (mosaicplasty) was found to be good for tackling lesions involving both cartilage and bone. However, recent literature has put it in to disrepute for various reasons. Sacrifice of normal cartilage areas of the joint, increased incidence of post-op haemarthrosis and limited availability of graft material for larger defects are a few of these. Other treatment option for such defects would be osteochondral allografts, at the cost of disease transmission and fear of rejection. To overcome these problems, we propose a novel technique involving the use of autologous cancellous bone plug combined with Autologous Chondrocyte Implantation for large osteochondral defects in the synovial joints.

Materials and Methods

A prospective trial of this technique was carried at the Robert Jones Agnes Hunt Orthopaedic Hospital, Oswestry. Seven young patients (age-37yrs) with osteochondral lesions of the knee (N=5) and the ankle (N=2) were included in the trial. All these patients presented with large osteochondral defects in the joints. The procedure of Bone-Plug ACI was explained to them and an informed written consent was obtained. At stage I, arthroscopic harvest biopsy of the cartilage was taken from the non weight bearing surface of the articular cartilage, for in-vitro culture in a dedicated Sir John Charnley Tissue Culture Laboratory. During stage II arthrotomy, the defect was drilled with MEGA-OATS instrumentation kit. The 3-dimensional measurements of the defect were made using the vernier calliper. The cylindrical bone plug was then harvested from the subchondral cancellous bone with the dowel drill, away from the base of the defect. This plug was impacted in the defect flush to the surface of the subchondral bone. The defect was then covered with a biological membrane and sutured with 6-0 vicryl. Cultured chondrocytes were injected underneath the patch. Results were evaluated at the end of 1 year by 3-D reconstruction CT Scans, clinical outcome using the Lysholm Score /Ankle Score , arthroscopically using the Oswestry Arthroscopic Score and histological analysis to observe the lateral and basal integration.

Results

The knee lesions were on the medial femoral condyle (N=4) and lateral femoral condyle (N=1). The ankle lesions were on the anterolateral aspect of the talus. The average size of the osteochondral lesions was 8mm×10mm×15mm. The Bone Plugs were taken from the non weight bearing surface of the distal femur (N=6) and from the distal tibia (N=1). The bone plugs were covered with a biological membrane which was native periosteum in five patients and porcine membrane, chondrogide in two patients. The seven patients were followed up to an average of 17.1 months. In case of knee joint, the average Lysholm score was 92/100, the ankle score was 84/100. The average arthroscopic score in these patients was 7/10 at one year. The histological cartilage from the recipient site at 1 year was Hyaline in two patients, Fibrocartilage in three patients and was mixed in two patients.

Conclusion-

The combination of autologous bone plug and Autologous Chondrocyte Implantation is synergistic. Bone plug gives immediate structural stability for early weight-bearing and reduces the rehabilitation time period. This is the main advantage over the sandwich technique described by other researchers in past. Presence of Bone Marrow Mesenchymal Stem Cells in the bone plug and Cultured chondrocytes on the surface make the Bone- Plug ACI appears to be more biological. We did not find any deleterious effects of this combined technique. Presence of all autologous tissues avoid disease transmission and no fear of rejection. Although the early results of this technique are promising, long term evaluation is needed to prove the efficacy of this procedure.