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Adult adipose mesenchymal stem cell implantation for one step knee chondral defects repair
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Purpose
Management of articular osteochondral defects, whether from trauma or from degenerative disease, continues to be a significant challenge for orthopaedic surgeons. Regenerative medicine, and particularly stem cell therapy, has become one of the main “one step surgery” choices. Adult mesenchymal stem cells (MSCs) are mainly isolated from bone marrow or fat tissue. We discuss the use of adult adipose tissue-derived stromal cells (ADSCs) for the repair of knee focal full thickness chondral defects by an improved technique (MyStemTM) for isolating adult viable mesenchymal stem cells from lipoaspirate within less than 30 minutes.

Methods and Materials
In local anesthesia, we extract, with a specifically created adipose tissue biopsy needle, the marrow tissue from adult adipose tissue of the abdomen. The vacuum syringe with the few ml of liposuction is, bedside in the OR room, connected to the collection bag of pre-treatment, where the injectate is mechanically filtered. The stromal-vascular fraction of cells is separated from the mature lipid-laden adipocytes and the water cell-free component by centrifugation according to a specific centrifugation protocol for 10 minutes. This fraction contains ADSCs in a large number, with yields of approximately 250,000 cells per gram of tissue. Adding fibrin glue to concentrated ADSCs, we obtain a sticky clot ready to be implanted in the osteochondral prepared defect.

Results
We have prospectively followed grade 3 and 4 chondral defects of the knee treated by ADSCs implantation with or without the use of a collagen membrane scaffold. All patients, treated by the same surgeon, have followed the same post-op regimen. Patients have, at short term follow-ups, showed improvements in all scores and no adverse reaction has been noted.

Conclusions
This procedure is simple, quick and low cost. It doesn’t require harvesting of cells and its associated donor site morbidity. The adipose tissue lipoaspirate procedure is simple and low-risk by the use of specific blunt-tipped biopsy needle. Direct culture in the OR of the adipose cells, without the need of collagenase lysis, makes the procedure easy and safe and perfectly adapting to the timing of a single step chondral defect repair procedure. One step patient-side surgery is certainly becoming the technique of choice for cartilage defects repair. This single-step ADSCs implantation procedure reduces time, costs and is less invasive to the patient, but although promising, needs more patients and longer follow-ups.