Reorientation Technique in Bone Marrow Aspirate eXtraction (BMAX) improves cell yield significantly and leads to superior clinical outcome in severe arthritis.

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Background: Cell-based therapies (CBT) have shown promise in modulating inflammation and slowing cartilage degradation, but up to now had no benefit as compared to PRP (platelet rich plasma). A standardized BMA protocol based on the reorientation technique was developed for KL grade III–IV knee OA, yielding superior clinical and molecular outcomes.

Methods: A prospective, multiple-arm clinical study was conducted in patients with Kellgren–Lawrence grade III–IV knee OA.

(1) Bone marrow was aspirated from the anterior and posterior iliac crest. Each patient served as his own control (anterior versus posterior).

(2) Bone marrow was harvested with the standard technique on the left side and the reorientation technique on the right side to optimize nucleated cell and mesenchymal stromal cell (MSC) yield. Each patient served as his own control (left versus right).

(3) Different needle sizes and manufacturers were compared.

(4) The BMA was processed chairside without expansion or manipulation into BMAC (bone marrow concentrate) using a centrifuge.

(5) Patients received single intra-articular injection of BMAC in one arm of the study and "BMA with reorientation technique" in the other arm of the study.

Clinical outcomes were assessed up to 6 years using IKDC, WOMAC, SF 36 and KSS and objective gait parameters. Safety and adverse events were recorded.

(6) General anesthesia and local anesthesia were compared.

Results:

(1) No difference in MSC cell count between anterior and posterior iliac spine.

(2) 18 times higher MSC yield in "BMA with reorientation technique" as compared to standard BMAC.

(3) 4 times superior cell yield with specific needles and techniques.

(4) 6 year results show significant increase of all clinical scores with BMAC in reorientation technique within the first year.

(5) No clinical difference between ”BMA with reorientation technique" and "BMAC" up to the second year.

(6) The BMA with reorientation technique can be done under local anesthesia, but standard BMAC can only be done under sedoanalgesia.

In 93% of 50 patients (mean age 64), all scores improved significantly from baseline at all time points ($p < 0.001$), indicating relevant changes in pain, symptoms, function, and quality of life. No serious adverse events occurred. Cell characterization revealed high viability and chondroprotective interleukines. In 7% of all patients a total knee arthroplasty was done after mean 24 months.

Conclusion:

Mesenchymal stem cell therapy (BMA-Injection) with reorientation technique is better than standard BMAC- or PRP-therapy with regards to cell count, viability and ease-of-use: Patients can be operated on in supine position and under local anesthesia and cells be retrieved from anterior. No operating room, no sedoanalgesia and no centrifuge is required. Clinical outcome of BMA in reorientation technique is better than standard BMAC therapy at substantially lower cost.