Role of Osteogenically Differentiated and Undifferentiated Stem Cells From Adipose Tissue and Bone Marrow On Bone Regeneration In Critical Sized Calvarial Defects

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Nothing to disclose
Objective of the Study

To examine the role of adipose-derived and bone marrow-derived stem cells and osteoblasts on bone regeneration
Materials and Methods

Cell Preparation

- Bone marrow
- Adipose tissue

Bone marrow derived stem cell (BMSC) → Osteogenic differentiation (BMSC-ob)

Adipose tissue derived stem cell (ASC) → Osteogenic differentiation (ASC-ob)

Fluorescent labelling (CM-Dil)
Materials and Methods
Experimental Model

Schmitz and Holinger
Critical sized (8 mm)
rat calvarial defect

Diameter: 8 mm
Materials and Methods

Experimental Groups

Group 1 (n=8) : No cells, no carrier
Group 2 (n=8) : No cells, only gelatin carrier
Group 3 (n=8) : ASC + gelatin carrier
Group 4 (n=8) : ASC-ob + gelatin carrier
Group 5 (n=8) : BMSC + gelatin carrier
Group 6 (n=8) : BMSC-ob + gelatin carrier
Materials and Methods

Evaluation

1. Defect measuring with computerized tomography (CT)
   - at 0, 2, 4, and 8 weeks postoperatively
2. Histological analysis
3. Fluorescent microscope (CM-DiI)
4. Immunohistochemistry (osteocalcin and vWF)
Results

Computerized Tomography

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Results

Computerized Tomography

Kruskal – Wallis test
- no significant difference between groups at 0, 2nd and 4th weeks (p>0.05)
- significant difference between groups at “8th week” (p<0.05)
Results
Computerized Tomography

Mann – Whitney U Test with Bonferroni Correction
- significant difference between 1st group and 3rd, 4th, 5th, 6th groups at 8th week
- significant difference between 2nd group and 3rd, 4th, 5th, 6th groups at 8th week
Results

Computerized Tomography

**Friedman and Wilcoxon Tests**

- no significant difference in 1st and 2nd groups between weeks
- significant difference in each cell-based therapy group (3, 4, 5 and 6) between 0. and 8th weeks
Results

Histology

Cell-based therapy groups (3-6) exhibited new bone islands
Results
Immunohistochemistry

Viable stem cells, osteoblasts and endothelial cells in the cranial defect site

CM-Dil (Invitrogen, USA)  Osteocalcin  vWF
Conclusion

Cell-based therapy groups (3, 4, 5 and 6) proved to have more osteogenic potential compared with the control and carrier groups (1 and 2).
Conclusion

There was no significant difference in terms of new bone formation between osteogenically induced and non-induced stem cells from bone marrow and adipose tissue.
Conclusion

Significance of the Findings

• Osteogenic differentiation is not a necessity for stem cells
• Adipose tissue is the preferred source with advantages of high yield and rapid expansion