Influence of bone substitute PerOssal® on bone marrrow mesenchymal stem cells

Hristina Obradović[1,*], Sebastian Häusner[2], Drenka Trivanović[1], Milena Živanović[1], Duško Spasovski[3], Marietta Herrmann[2] and Aleksandra Jauković[1]

[1]Group for Hematology and Stem Cells, Institute for Medical Research, University of Belgrade, 11000 Belgrade, Serbia
[2]IZKF Group Tissue Regeneration in Musculoskeletal Diseases, University Hospital of Wuerzburg, Wuerzburg, Germany
Bernhard-Heine-Center for Locomotion Research, University of Wuerzburg, Wuerzburg, Germany
[3]Institute of Orthopedics "Banjica", Belgrade, Serbia

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INTRODUCTION: PerOssal® is biologically degradable and osteoconductive bone substitute consisting of nanocrystalline hydroxyapatite (51.5 %) and calcium sulfate (48.5 %) [1]. It is used for bone defect treatments as a synthetic carrier for antibiotics suitable for infected areas. Since the effect of PerOssal® has not been investigated so far in combination with mesenchymal stem cells (MSC) for bone tissue regeneration, we aimed to explore in vitro whether this material can support growth and osteogenesis of MSC from bone marrow (BM-MSC).

Materials and Methods: BM-MSC were isolated from BM mononuclear cell fraction of human healthy donors and cultivated in standard conditions. One pellet of PerOssal® was dissolved in 10 ml of Phosphate Buffered Saline and added to cells in different ratios. Viability of BM-MSC was assessed by MTT test [2] after one, five and seven days. Migration capacity of BM-MSC was followed by both scratch assay and transwell system [3], while osteogenic potential was investigated by histochemical staining after induced osteogenic differentiation [4].

RESULTS AND DISCUSSION: Initial experiments showed that BM-MSC adhere to PerOssal® surface. Considering that culture media induced decomposition of PerOssal® which aggravated functional evaluation of attached BM-MSC , our further in vitro studies were directed on testing the effects of different PerOssal® dilutions on BM-MSC functional properties. Our results demonstrated that at all dilutions tested PerOssal® didn't affect viability of BM-MSC in a short-term treatment, while in higher doses it decreased cell viability at day 7. At the same time point, morphology of BM-MSC was changed with high dose of PerOssal®. On the other side, at lower doses PerOssal® stimulated migration of BM-MSC as demonstrated by both scratch and transwell assays. As for the analyses of BM-MSC osteogenic differentiation, stimulatory effect on early osteogenesis was noticed for lower PerOssal® doses, opposite to decreased BM-MSC osteogenesis observed when higher doses were applied.

CONCLUSIONS: These data imply that osteoinductive effect of PerOssal® related to BM-MSC recruitment likely considers later phases of material resorption corresponding to its lower concentrations. For potential use as a biomaterial for cell therapy in tissue engineering, PerOssal® should be applied in lower doses.

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*Corresponding author E-mail: hristina.obradovic@imi.bg.ac.rs