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Evaluation of new biodegradable magnesium-based implants for maxillofacial applications *in vitro.*

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Background: A variety of materials have been used for bone augmentation, distraction osteotomy, and in post-cancer patients following tumor removal. However, a temporary metal implant that would resorb after successful treatment is a new concept. Magnesium was suggested as a suitable material for these purposes because it is biocompatible, has better mechanical properties than titanium, and stimulates new bone formation. The majority of studies on magnesium's biocompatibility *in vitro* assess short-term magnesium extract's effect on the cells. The aim of this study was to evaluate the influence of direct exposure of magnesium alloys on the bioactivity of primary human mesenchymal stem cells (MSC).

Materials and Methods: Pure Mg, Mg2Ag, WE43 and Mg10Gd were tested for biocompatibility. The study consisted of assessment of the cell viability by MTT test, evaluation of the alkaline phosphatase (ALP) content, studying cell morphology under the light microscope, SEM and TEM, along with determination of calcification and pH changes induced by magnesium.

Results: The number of viable cells in presence of all magnesium samples was stable over the observation period of 21 days. The inhibition of ALP content in osteogenic differentiating MSC was caused by pure Mg at day 14 and 28. All other magnesium alloys did not affect the ALP content. Exposure of MSC to magnesium increased the amount of lysosomes and endocytotic vesicles. Cellular attachment was generally the best to the crystals that formed on all materials' surface. There was observed a decrease in Ca^{2+} in the medium from day 1 to day 14.

Conclusion: In respect to the cell morphology, cell viability and differentiation, cell density and the effect on the surrounding pH, Mg2Ag showed the most promising results. All magnesium materials induced calcification which is beneficial for dental applications.

Key words: biocompatibility, magnesium, primary mesenchymal stem cells.

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