**Evaluation of resorbable magnesium plates and screws using a miniswine maxillofacial fracture repair model**

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**Background:** Absorbable polymers have become attractive to avoid titanium disadvantages in maxillofacial surgery such as necessity of implant removal or temperature sensitivity¹. However, their main limiting factor is the required size and thickness for maintaining mechanical stability during the fracture-healing period. Hence, despite their bulkiness, the use in humans is restricted to non-loading environments. Magnesium (Mg) biomaterials have emerged as potential candidates in maxillofacial surgery and orthopedics due to their ability for cold-bending and mechanical properties, making them suitable for load-sharing implant applications in fracture repair².

**Aim:** The objective of this work was to demonstrate the suitability of a magnesium alloy for load-sharing applications using yucatan minipigs for maxillofacial in vivo assessments.

**Materials and Methods:** Clinically relevant fractures were performed under general anesthesia in the supraorbital rim and the zygoma arch of seven (7) yucatan miniature pigs (Sinclair Bio Resources, ME, USA). Osteotomies were created and the corresponding bone fragments were fixed with plates and screws. Five (5) animals were implanted with Mg plates and screws (Synermag alloy from Magnesium Elektron, coated by a proprietary plasmaelectrolytic oxidation process; DePuy Synthes), while two (2) animals received resorbable 85:15 polylactide-co-glycolide (PLGA) commercial plates and screws as controls (RapidSorb; DePuy Synthes). The magnesium plates were smaller and thinner than the control PLGA plates. Live post-op computed-tomography (CT) scans were performed at different implantation time points. Following necropsy, undecalcified bone samples were stained with Goldner’s in order to quantify osseointegration (bone linear apposition) was assessed in presence of all biomaterial types.

**Results:** Live CT 3D reconstructions obtained at 19-20 days post-surgery have shown a perfect bone alignment in the orbital rim (non-loading) for both Mg and PLGA. For the moderately load-bearing zygoma arch, the smaller and thinner magnesium implants held the bone in place similarly to the larger PLGA devices. A partial healing of the osteotomies was observed after 1 month under histology.

![Figure 1](image)

**Figure 1:** A and C: Live CT images of orbital rims and zygomatic arches (post-surgery), B and D: 20 and 19 days post-implant (Mg and PLGA respectively). E: Histology for orbital Mg devices. F: Histology of orbital rim for PLGA devices.

**Conclusion and clinical implication:** This miniswine model allowed to assess magnesium plates and screws for maxillofacial clinical applications. Results suggest that Mg represents promising material for load-sharing applications. Minipigs with longer time points will focus on the assessment on adverse effects, if any.

**References:**