COMPANION ANIMAL
Research Award

# 3D-printed implants loaded with selenium nanoparticles to treat osteosarcoma: an in vitro study

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**Introduction**
Osteosarcoma (OSA) is treated with chemotherapy and either amputation or limb sparing surgery. Although the primary tumour can be completely resected, local bone tumour recurrence may occur due to the aggressive nature of OSA. In order to minimize this risk, selenium nanoparticles (SeNP), with demonstrated anti-cancerous effects, can be employed (1). The main aim of the present study was to determine the effective concentration of selenium ions to kill OSA cells. Furthermore, the cell-biomaterial interaction was studied on 3D-printed degradable implants.

**Materials and methods**
The effect of different dosages (0-10 µg/ml) of SeNP or sodium selenite (SSE; a positive control) was assessed using MTT-assays on three human and three canine OSA cell lines, and on healthy canine bone marrow-derived mesenchymal stromal cells (MSCs), native and osteogenically differentiated. In addition, the adhesion, viability and proliferation of MSCs and OSA on 3D-printed empty implants was evaluated with scanning electron microscopy, DNA assays and life-dead staining.

**Results**
SeNP had a stronger cytotoxic response on OSA cells compared to SSE (lowest inhibitory concentration 0.1 µg/ml vs. 2 µg/ml, respectively), particularly on canine OSA cell lines. Both MSC types were negatively affected at concentrations ≥2 µg/ml (SSE) or ≥0.5 µg/ml (SeNP). Preliminary data showed that MSCs and OSA cells were able to adhere and proliferate on unloaded 3D-printed implants

**Conclusion**
Our data suggests that SeNP are potent OSA inhibitors, although there is a very small safety window for MSCs. Preliminary results suggest that calcium-phosphate based implants provided a suitable environment for cell adhesion and proliferation. Currently, we are investigating the cell-biomaterial interaction in SeNP loaded implants as a first step towards totally resorbable 3D-printed personalised implants for OSA canine patients.

References

(1) Stolzoff M, Webster TJ. Reducing bone cancer cell functions using selenium nanocomposites. J Biomed Mater Res Part A 2016:104A:476–482