

## Therapeutic and regenerative biomaterial for bone cancer treatment

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Currently, osteosarcoma is the most common bone cancer which mainly affects young people. Surgical resection of tumor followed by chemotherapy for micro-metastasis inhibition constitutes the current standard procedure. However, chemotherapy treatment uses pharmacological agents with the effect of blocking cell proliferation, without any distinction between healthy and cancer cells. In recent years, several studies have focused the attention on Photodynamic Therapy (PDT) or Photothermal treatment (PTT) as minimally invasive therapeutic procedure that can apply a selective cytotoxic activity toward cancer cells. Hence, the development of innovative treatments able to inhibit metastases progression and in the same time to promote the formation of a new tissue is a great challenge. Here, an innovative strategy based on bifunctional injectable material able to inhibit bone tumor progression and, at the same time, to induce new tissue formation is reported. The activity is ascribed to the capability of exfoliated black phosphorus (2D BP) to inhibit cancer cell proliferation and simultaneously to stimulate newly forming bone tissue generation after osteosarcoma resection. The osteoinductive properties are improved by using calcium phosphate material as carrier of 2D BP. The injectable system, prepared at room temperature by sol-gel technology, shows a full injectability and important bioactive and *in vitro* biological properties. *In vivo* studies validate the regenerative properties of 2D BP loaded-calcium phosphates on rat model. These beneficial effects prompt the application of injectable system as a highly promising candidate for bone biomedical applications.