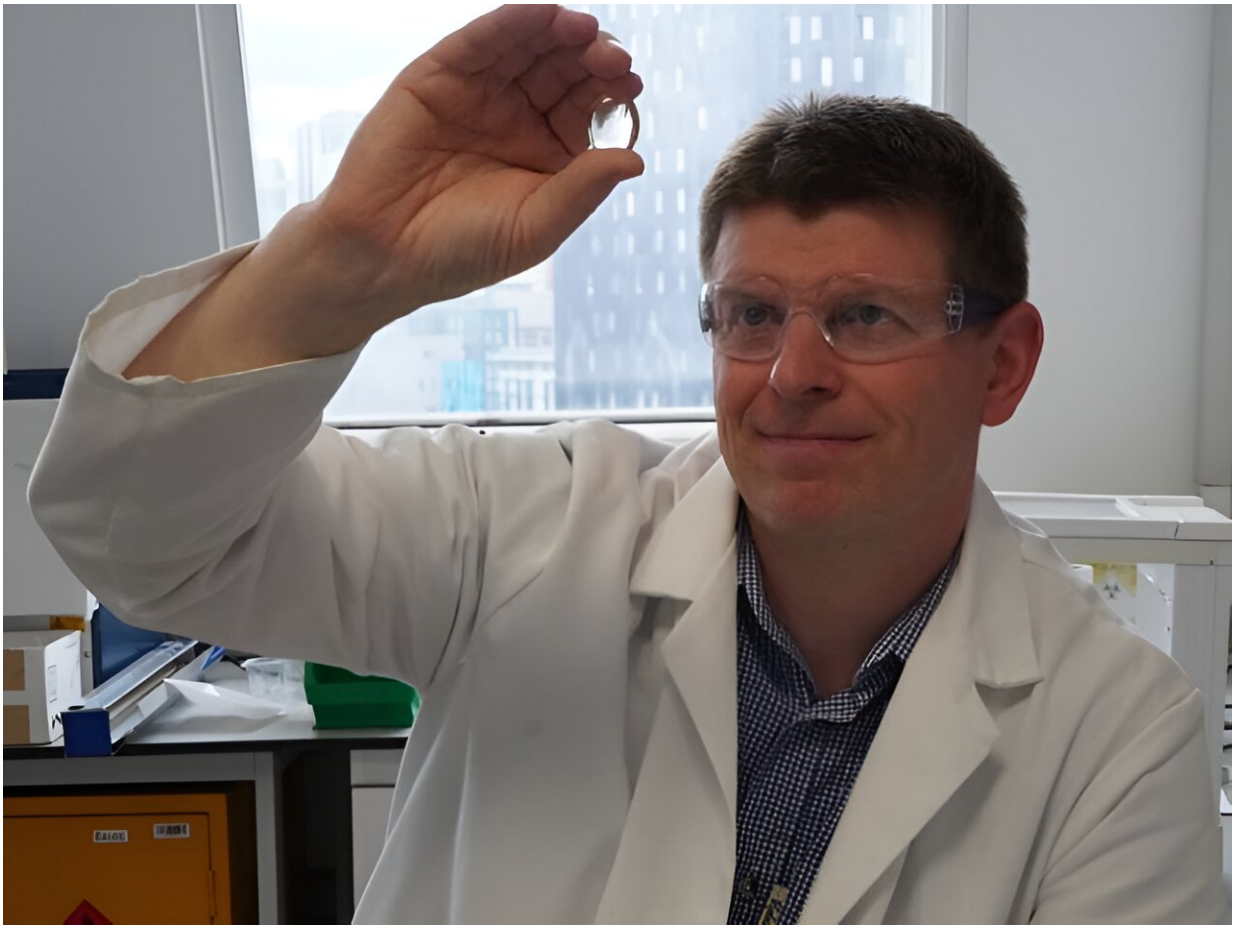
Preclinical study finds novel bone cancer therapy has 99% success rate

September 10 2024



Professor Richard Martin. Credit: Aston University

Bioactive glasses, a filling material which can bond to tissue and improve

the strength of bones and teeth, has been combined with gallium to create a potential treatment for bone cancer.

Tests in labs have found that bioactive glasses doped with the metal have a 99% success rate of eliminating cancerous cells and can even regenerate diseased bones.

The research was conducted by a team of Aston University scientists led by Professor Richard Martin who is based in its College of Engineering and Physical Sciences.

In laboratory tests, 99% of osteosarcoma (bone cancer) cells were killed off without destroying non-cancerous normal human bone cells. The researchers also incubated the bioactive glasses in a simulated body fluid and after seven days they detected the early stages of bone formation.

Gallium is highly toxic, and the researchers found that the "greedy" cancer cells soak it up and self-kill, which prevented the healthy cells from being affected. Their research paper, "Multifunctional Gallium doped bioactive glasses: a targeted delivery for antineoplastic agents and tissue repair against osteosarcoma," is published in the journal *Biomedical Materials*.

Osteosarcoma is the most commonly occurring primary bone cancer and, despite the use of chemotherapy and surgery to remove tumors, survival rates have not improved much since the 1970s. Survival rates are dramatically reduced for patients who have a recurrence and primary bone cancer patients are more susceptible to bone fractures.

Despite extensive research on different types of bioactive glass or ceramics for bone tissue engineering, there is limited research on targeted and controlled release of anti-cancer agents to treat bone cancers.

Professor Martin said, "There is an urgent need for improved treatment options and our experiments show significant potential for use in bone cancer applications as part of a multimodal treatment.

"We believe that our findings could lead to a treatment that is more effective and localized, reducing side effects, and can even regenerate diseased bones.

"When we observed the glasses, we could see the formation of a layer of amorphous calcium phosphate/ hydroxy apatite layer on the surface of the bioactive glass particulates, which indicates bone growth."

The glasses were created in the Aston University labs by rapidly cooling very high temperature molten liquids (1450o C) to form glass. The glasses were then ground and sieved into tiny particles which can then be used for treatment.

In previous research, the team achieved a 50% success rate, but although impressive, this was not enough to be a potential treatment. The team are now hoping to attract more research funding to conduct trials using gallium.

Dr. Lucas Souza, research laboratory manager for the Dubrowsky Regenerative Medicine Laboratory at the Royal Orthopaedic Hospital, Birmingham worked on the research with Professor Martin. He added, "The safety and effectiveness of these biomaterials will need to be tested further, but the initial results are really promising.

"Treatments for a bone cancer diagnosis remain very limited and there's still much we don't understand. Research like this is vital to support in the development of new drugs and new methodologies for treatment options."

More information: Shirin B Hanaei et al, Multifunctional gallium doped bioactive glasses: a targeted delivery for antineoplastic agents and tissue repair against osteosarcoma, *Biomedical Materials* (2024). DOI: 10.1088/1748-605X/ad76f1