New X-ray technique could improve bomb detection and breast cancer treatment

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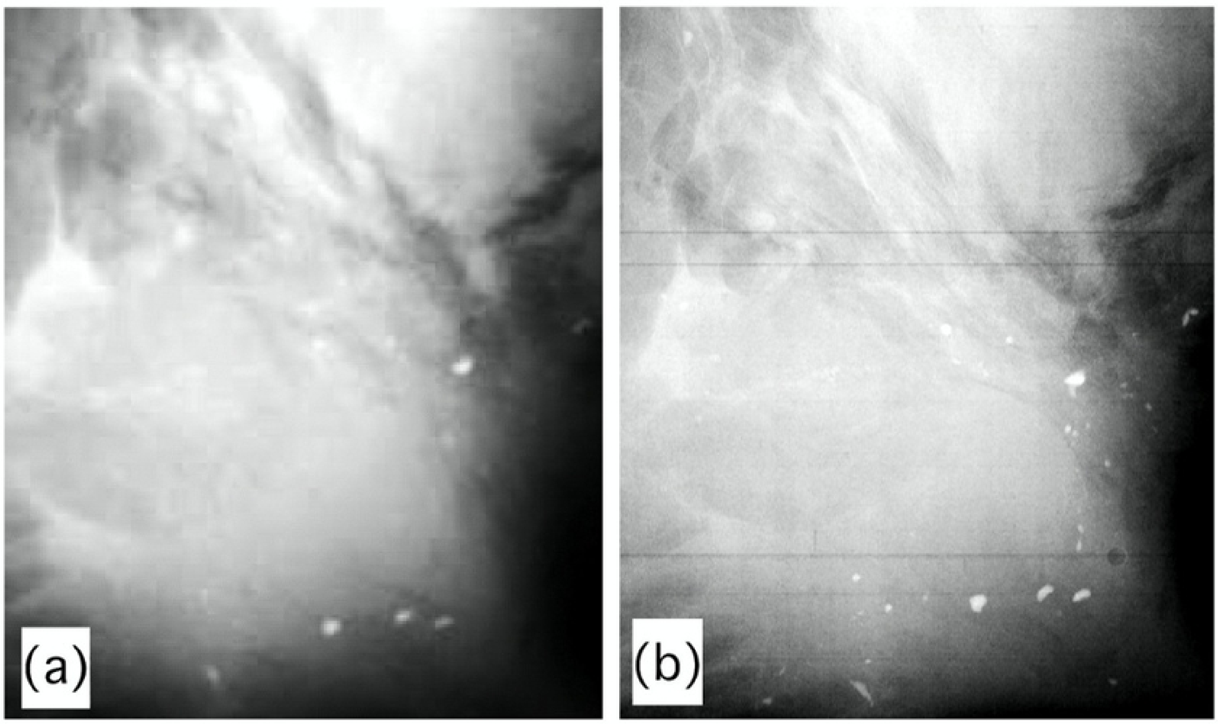

Two images showing a hospital image of an in vitro breast specimen (left) and one taken using phase contrast X-ray imaging at UCL (right). The phase-contrast image has detected clustered calcifications far more accurately than the conventional image, suggesting with more certainty the possibility of breast cancer and allowing for better visualisation of tumour details Credit: University College London

An exciting X-ray imaging technology has been successfully developed to the point where it is now ready for translation into all kinds of beneficial applications, including potentially life-saving uses in security and healthcare.

Funded by the Engineering and Physical Sciences Research Council (EPSRC), a major five-year project led by UCL (University College London) has achieved this breakthrough. The work also involved dozens of industrial, academic and research partners in the UK and worldwide.

Compared with conventional X-rays, the technology can, for example, identify tumours in living tissue earlier and spot smaller cracks and defects in materials. This is because it excels at determining different shapes and different types of matter - a capability that conventional X-rays could only match by using prohibitively high doses of radiation.

The technique at the heart of the advance is called phase-contrast X-ray imaging. Instead of measuring the extent to which tissue or materials absorb radiation - as in conventional X-ray imaging - it measures the physical effect that passing through different types of tissue or material has on the speed of the X-ray itself.

Professor Alessandro Olivo, who led the project team, says: "The technique has been around for decades but it's been limited to large-scale synchrotron facilities such as Oxfordshire's Diamond Light Source. We've now advanced this embryonic technology to make it viable for day-to-day use in medicine, security applications, industrial production lines, materials science, non-destructive testing, the archaeology and heritage sector, and a whole range of other fields."

This vast potential is already beginning to be explored. For example:

- Under licence, Nikon Metrology UK has incorporated the

technology into a prototype security scanner. This is currently being tested and further developed to provide enhanced threat detection against weapons and explosives concealed, for example, in baggage.
- Building on the EPSRC-funded work, a new three-year project supported by the Wellcome Trust will see the Nikon Metrology/UCL team develop a prototype scanner for use during breast cancer surgery in collaboration with Barts Heath and Queen Mary University of London. The aim is to help surgeons determine the exact extent of the malignancy and to reduce the need to recall patients for further operations, resulting in more effective breast conservation surgery, less need for full mastectomies and more rapid treatment.
- The technology can even detect some tissue types invisible to conventional X-ray machines, such as cartilage, and plans are proceeding to set up a spinout company to take this aspect towards commercialisation.

Professor Olivo says: "This has the potential to be incredibly versatile, game-changing technology. We're currently negotiating with a number of companies to explore how it could be put to practical use. There's really no limit to the benefits this technique could deliver."

Provided by Engineering and Physical Sciences Research Council

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