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IISc explores use of ultrasound to attack oral cancer cells

07 July 2026 | News

Ultrasound drastically reduces the cancer cellsâ?? ability to migrate and invade surrounding tissue

Oral cancer is a major health challenge in India, where tobacco and areca nut use contribute substantially to the disease burden. Despite advances in surgery, chemotherapy, and radiotherapy, treatment remains difficult because current

approaches can damage healthy tissues along with cancer cells, often affecting patients' quality of life.

In a new study, researchers at the Indian Institute of Science (IISc), in collaboration with clinicians at MS Ramaiah Medical College and Hospitals, Bengaluru, explored whether low-frequency ultrasound mechanical stimulation could selectively kill oral cancer cells. The team worked with patient-derived oral tumour samples that better reflect variations among Indian patients.

The team found that oral cancer cells are surprisingly vulnerable to the moderate mechanical stimulations produced by ultrasound. This vulnerability appears to arise from reduced levels of Tropomyosin 2.1, a mechanosensory protein that helps body cells sense and withstand physiologically relevant mechanical stimulation. When exposed to ultrasound-driven mechanical stimulation, oral cancer cells underwent selective cell death, while healthy oral epithelial cells remained unharmed.

The team also found that ultrasound drastically reduces the cancer cells' ability to migrate and invade surrounding tissue.

"The clinical collaboration was very important because it allowed us to work with patient-derived oral tumour samples rather than relying only on standard cell lines developed in Western countries," said the researchers. "In the future, we want to test this approach in more physiologically relevant models and explore whether ultrasound can be combined with existing treatments to improve drug penetration and therapeutic outcomes."