

Breath-holding technique could improve outcomes for radiotherapy patients

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Credit: Cancer Research UK

A technique that will enable cancer patients to hold their breath during prolonged bouts of radiotherapy treatment has been developed by researchers at the University of Birmingham.

In the study, published in *Radiotherapy and Oncology*, researchers demonstrated that, by safely increasing [oxygen levels](#) in the lungs and removing carbon dioxide from blood, it is possible for individuals to hold their breath for multiple four-minute periods during treatment.

It will mean patients with tumors in the chest and abdomen can stay immobile for longer periods to enable more targeted treatment with radiation beams. During treatment, a number of beams are typically directed from several different angles to intersect at the tumor and the less the patient moves, the more targeted the treatment can be.

Dr. Mike Parkes, from the School of Sport, Exercise and Rehabilitation Sciences at the University of Birmingham, explains: "Radiotherapy is still a key treatment for tackling cancer, but success depends at least in part on patients being able to remain as still as possible while the treatment is ongoing. This is a particular challenge for patients being treated for cancers in the chest and abdomen. These regions can move up to 4cm each time a breath is taken, limiting the accuracy of the radiotherapy.

"People often believe that it's only really possible to hold your breath safely for between 30 seconds and a minute, but in fact there are no risks to a five-minute breath hold under carefully controlled clinical conditions."

A cohort of 30 volunteers, both male and female and aged between 20 and 25 years old, took part in the study. For a number of minutes they were given oxygen-enriched air to breathe, to increase levels of oxygen in their lungs, and their blood [carbon dioxide](#) level was lowered by hyperventilating them with a mechanical ventilator (via a facemask). This enables them to breath-hold safely for much longer than normal. With practice over a number of days they learned to hold their breath safely and consistently for about 6 minutes.

Once they could do this, the participants were taught to breath-hold multiple times in a single session. In this exercise, they were asked to hold their breath for ~ four minutes, and then, following a break, they were re-hyperventilated with oxygen before breath-holding again. They could do this ~4 minute breath-hold eight times in a row and could still do a final ninth breath-hold of six minutes.

Overall, the researchers demonstrate that it should be both possible and safe for patients to breath-hold for a total of about 13 minutes (3 breath-holds) within a treatment session lasting just under 20 minutes. In a 65-minute session, patients should be able to breath-hold for about 41 minutes (9 breath-holds). Another important feature demonstrated by these results is that, if for any reason a treatment breath-hold has to be terminated early, it is simple to recover one or more breath-holds.

The study builds on earlier work by the team in which the technique was designed to help patients undergoing treatment for breast cancer to hold their breath during a five-minute treatment period. Part of the technique, in which patients' breathing is controlled using the ventilator is currently being explored further in hospitals in Newcastle, as well as at centers in Belgium and the Netherlands.

More information: Michael John Parkes et al. The feasibility, safety and optimization of multiple prolonged breath-holds for radiotherapy, *Radiotherapy and Oncology* (2019). DOI: [10.1016/j.radonc.2019.06.014](https://doi.org/10.1016/j.radonc.2019.06.014)

Provided by University of Birmingham

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