PRINT-Radiation gets personal for patients with skin cancer

Skin cancer is the most common cancer in the United States and current estimates are that one in five Americans will develop skin cancer in their lifetime. Some people with skin cancer that's on the surface of the skin can still require large doses of radiotherapy, but precise delivery can be challenging. Skin tissue is not a flat surface so it's difficult to give a uniform and accurate amount of radiation.

Enter an innovation that can help provide a more localized, effective delivery of the treatment – a device called a radiation bolus.

"Normally when a beam hits the skin, it'll dissipate and that'll increase how the treatment affects that area. And so if it's right on the surface of skin, it can dissipate, and you can't get the correct dose in the way that you need. So a bolus is a piece of silicone that will move that surface of the skin kind of out so that the treatment area can get affected properly."

That's Reid Jockisch, an engineer with Jump Trading Simulation & Education Center. He helps design, fabricate and rapidly 3D-print patient-specific boluses that can be used throughout a patient's treatment. He says software combines patient CT scans with computer-generated radiation planning data to create models sent to Jump engineers for 3D printing.

The material conforms perfectly to the patient's skin, Jockisch explains.

"It'll literally just stick to the skin because it's silicone and they're soft and stretchy. You can see it's pretty malleable and would be comfortable to wear and it would just like sit right on the eye socket on the nose, really in the ear in and around the ear, very comfortably."

The method of creating a bolus eliminates the need for patients to come into their oncologist's office to get fitted for the device.

"The scans that are already a part of their treatment plan can be created or can create the models that we would need to create this so we can kind of do all of it in the background."

Jockisch says oncologists report feeling more confident using a patient-specific device, rather than a commercially-made bolus which might not provide the proper thickness or fit.

"This bolus is better than some of the ways it's been done in the past or some of the ways it's still sometimes done when it's not this kind of hard-to-reach place." Jockisch continues, "And what's used in those cases is really a flat piece of silicone, and that on a patient's nose or ear can create an air gap which changes the way that the radiation interacts with the bolus and that patient's cancer, which might lower the dose or increase the amount of treatments that are necessary for that patient."

This engineering solution is one of the benefits of bringing engineers and clinicians together to provide better treatment. Jockisch says it's the reason he became a bioengineer.

"Having an avenue to help a patient have a better experience, whether that be through some of these cancer treatments or some potential new solutions that we might be able to find with the building of the new Cancer Institute is absolutely one of the best parts of my job."

Jump engineers could be busy with the opening of the new OSF Cancer Institute on the campus of OSF HealthCare Saint Francis Medical Center in Peoria in February. But Reid says handling a higher volume of requests should be ok because the process to 3D print a patient-specific bolus takes between two to eight hours and he believes as technology evolves, that time will continue to be even shorter.