

Radiation Therapy

Radiation therapy is a clinical modality that utilizes ionizing radiation to treat patients with malignant neoplasias.

The goal of radiation therapy is to deliver a precisely measured dose of radiation to a defined tumor volume with as minimal damage as possible to surrounding healthy tissue, resulting in eradication of the tumor, a high quality of life, prolongation of survival, or palliation of symptoms at a reasonable cost (Halperin et al., 2018).

Advances in computer and electronic technology led to the development of more sophisticated, precise, and accurate treatment planning and delivery techniques including Surface Guided Radiation Therapy (SGRT).

Surface Guided Radiation Therapy (SGRT)

SGRT is a 3D laser light positioning tool with camera technology to capture real-time surface data in six degrees of freedom to position and monitor patients during radiation treatments with the largest field of view possible in radiation therapy (Batista et al., 2020). The laser light is projected onto the patient during setup and treatment to monitor the patient's breathing and to ensure patient position is within the suggested parameters.

SGRT is complimentary to Image Guided Radiation Therapy (IGRT) and is intended to replace the traditional 3-point positioning that used permanent tattoos on patients, as no permanent skin markings are necessary.

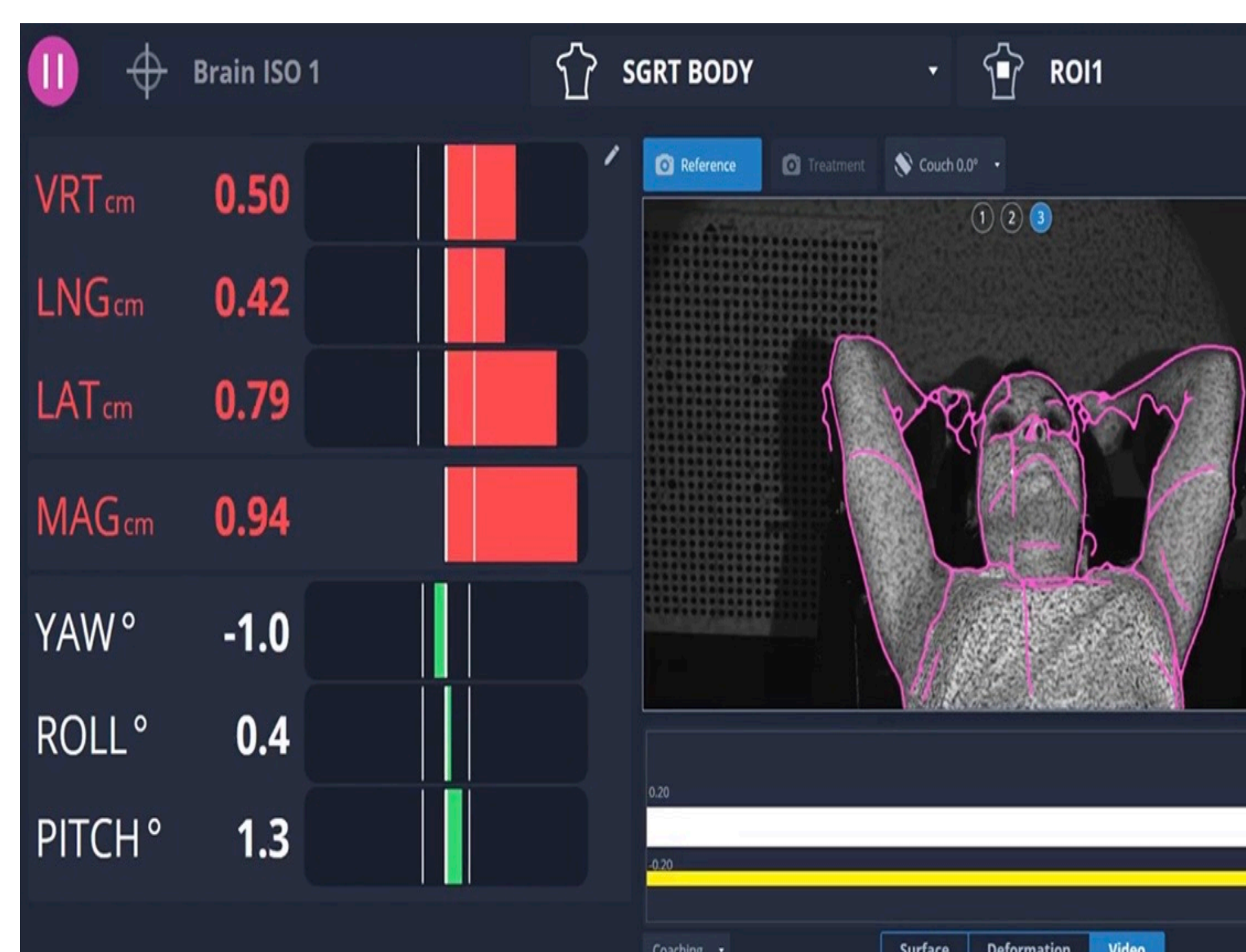
SGRT is non-ionizing so safe continuous monitoring can be completed throughout the entire treatment process providing real-time feedback and data to aid in making high-level clinical decisions and shortening treatment times which is beneficial to patients.

Advantages of Surface Guided Radiation Therapy

- SGRT does not require external permanent skin markings, or tattoos, on patients regardless of type, size, or location of tumor.
- SGRT provides submillimeter spatial resolution in 3D imaging without any dose to the patient during treatment.
- The field of view with SGRT is the largest of any available in-room imaging technology in all of radiation therapy.
- External anatomical changes are easier to identify visually with the use of SGRT versus the use of tattoos.
- SGRT provides real-time feedback throughout the entire treatment process allowing for easy data collection about position, surface, and respiratory state that could be used to assist in high-level clinical decisions in the care being given to the patient.

(Batista et al., 2020).

Figure 1



Cleveland Clinic. (2022). Tattooless radiation therapy benefits more than skin deep. Consult QD. [Photograph].

Figure 1 is a representation of a patient setup using SGRT that a radiation therapist would utilize during treatment to safely monitor patient condition and position.

Use of Patient Tattoos and the Disadvantages

For decades, permanent skin tattoos were used to deliver radiation therapy. Each patient received about 3 tattoos which were used as setup markers or as isocenter markers. The disadvantages of tattooing patients include:

- The tattoos can act as a constant reminder of the disease and the patient's fight against it, which can lead to psychological hardship.
- The ink being used for tattooing may diffuse under the patient's skin, causing a large discolored area, allergic reactions, skin infections, and bacteremia.
- Tattooing patients is more time consuming due to the need to physically move or adjust the patient into the exact position.

(Moser et al., 2020).

Patient Survey

Between February and August of 2018, women who were members of the Young Survival Coalition (YSC) that were diagnosed with breast cancer under age 40 were surveyed on their feelings towards the tattoos received during their cancer treatment. A total of 142 women answered the survey (Moser et al., 2020).

Figure 2

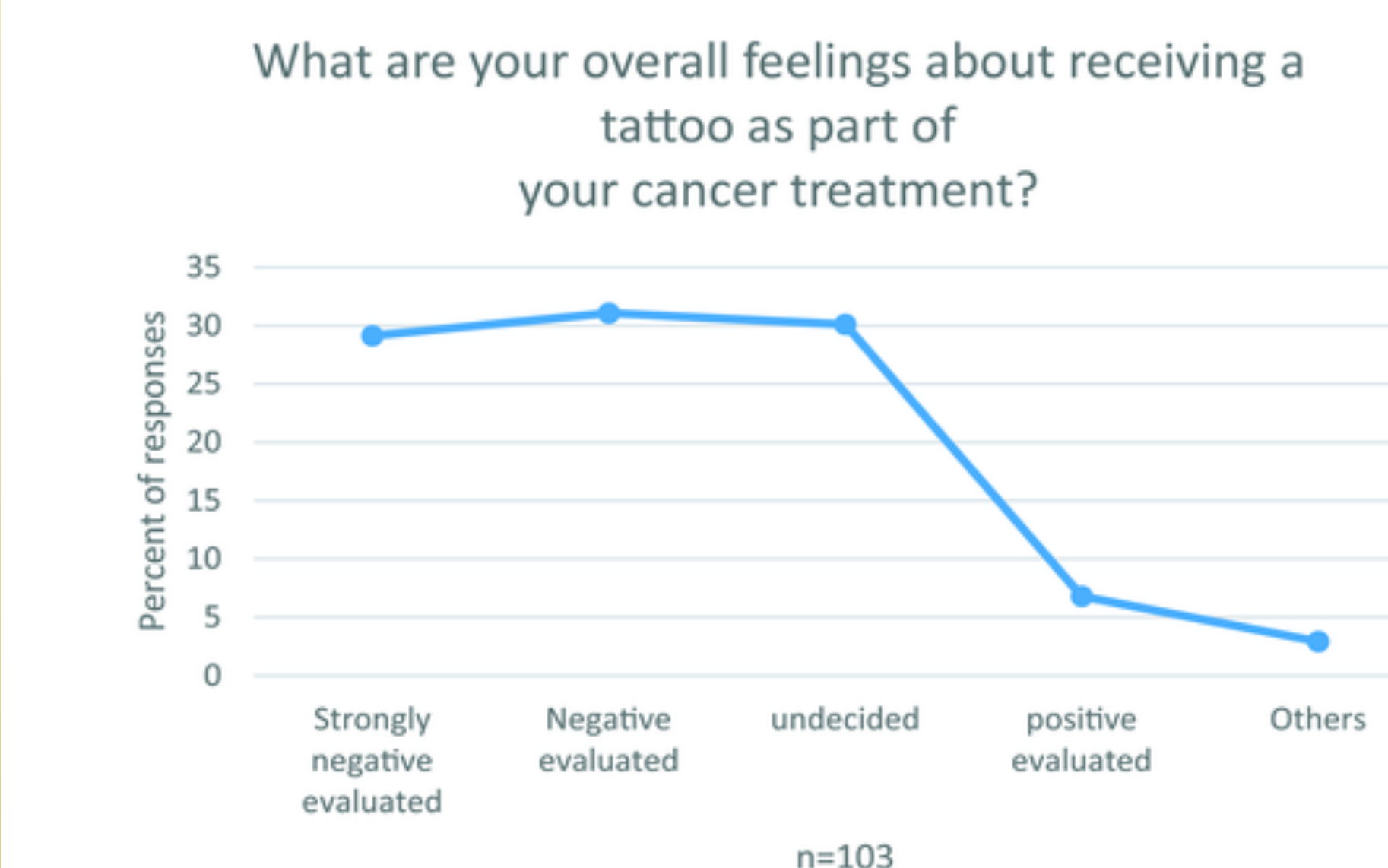


Figure 2. Overall feeling of tattoos. Moser, T., Creed, M., Walker, R., & Meier, G. (2020). Radiotherapy tattoos: Women's skin as a carrier of personal memory-What do we cause by tattooing our patients?. *The breast journal*, 26(2), 316–318.

Survey Results

According to the survey and **Figure 2**, about 61% of patients reported "strongly negative" and "negative" feelings towards receiving tattoos as a part of their cancer treatment. About 7% of patients reported "positive" feelings towards receiving tattoos as a part of their cancer treatment (Moser et al., 2020).

Future Outlook for SGRT

SGRT was originally created as a tool to replace permanent skin marks for patient positioning. Research shows that the volume of information and data provided by the treatment tool far exceeds replacing skin marks (Batista et al., 2020).

SGRT is aimed to become a resource that could potentially benefit every radiation therapy patient by guiding multiple aspects of the clinical decision chain. Future developments with SGRT are researching options for additional information that will improve workflow and provide safety benefits such as patient identification, collision avoidance, cross-check of immobilization devices and bolus position (Hosiak & Pawlicki, 2018).

Figure 3



Figure 3. Medical University of South Carolina Health. (2023). *Protect your heart with surface guided radiation therapy* [Photograph].

Figure 3 demonstrates the laser light monitoring of SGRT in the radiation treatment room.