

Electron Beam Radiation Therapy for Superficial Skin Lesions

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What is Radiation Therapy?

Radiation therapy is the use of high-energy x-rays or other particles to destroy cancer cells. Therapy damages cancer cells, making it harder to reproduce. Although radiation therapy affects both cancer cells and normal cells, the normal cells have the ability to repair. When it is not possible to destroy all the cancer, doctors may use radiation therapy to shrink tumors and relieve symptoms. The radiation therapy regimen consists of a planned number of treatments given over a set period of time. There are two types of radiation treatment options, external and internal. This presentation will be demonstrating the effects of external beam electron radiation therapy (Radiation Therapy, 2020)

Electron Beam Radiation Therapy

Electron beam radiation therapy is used for treatment of superficial lesions, with a depth dose of typically 0-3 cm deep. The two diagnostic outcomes with electron beam therapy are the use of spot treatment or total skin electron beam therapy (TSEB) (Memorial Sloan Kettering, 2022). Spot treatment is specific to one or more areas on the body and is delivered after proper location is found during a simulation. TSEB is done without treatment planning and covers the entire surface of the patients skin. The radiation therapist's job during an electron beam treatment is to be aware of changing skin reactions, movement as radiation is being administered, and an accurate setup based on the original simulation.

Common uses of Electron Beam Radiation Therapy

T-cell lymphoma, Mycosis fungoides lymphoma, basal cell and squamous cell skin cancers and breast cancer lumpectomy site boost are all cancerous uses for treatment.

Keloids are non-cancerous, overgrown areas of scar tissue included in the spectrum of fibroproliferative disorders (Hwang, 2022). Electron beam radiation therapy has been evaluated as an effective treatment option in reducing the local recurrence, and demonstrate clinical benefits of postoperative radiation therapy for keloids (Hwang, 2022).

Treatment Setup

Simulation

Once the treatment area is mapped out by the physician, the patient receives the right dose of radiation. This ensures the radiation dose to nearby tissue is as small as possible (Memorial Sloan Kettering, 2022).

Positioning

The patient will be in a reoccurring position for the duration of their treatments. This can become difficult for the elderly especially. In order to properly hold positions, immobilization devices can be used.

Patient Treatment Planning Methods

Dosimetrists and physicists work together to create the treatment plan, customized to each patients diagnoses.

Majority of treatments are given 5 days a week for 4 weeks (Memorial Sloan Kettering, 2022). The patient can expect the total process from time of arrival to take an estimated 15-20 minutes each day. Radiation demonstrates a cumulative affect on the body, meaning as treatment continue, the common electron beam therapy side effects will appear to worsen. Some common side effects include skin becoming itchy, red, and dry.

Proper images will be obtained to document the setup of the treatment for therapist reproducibility



The image above demonstrates the linear accelerator which delivers the radiation (Long, 2019)



Equipment

The image below demonstrates the treatment and motion management systems at display for radiation therapists during a treatment.

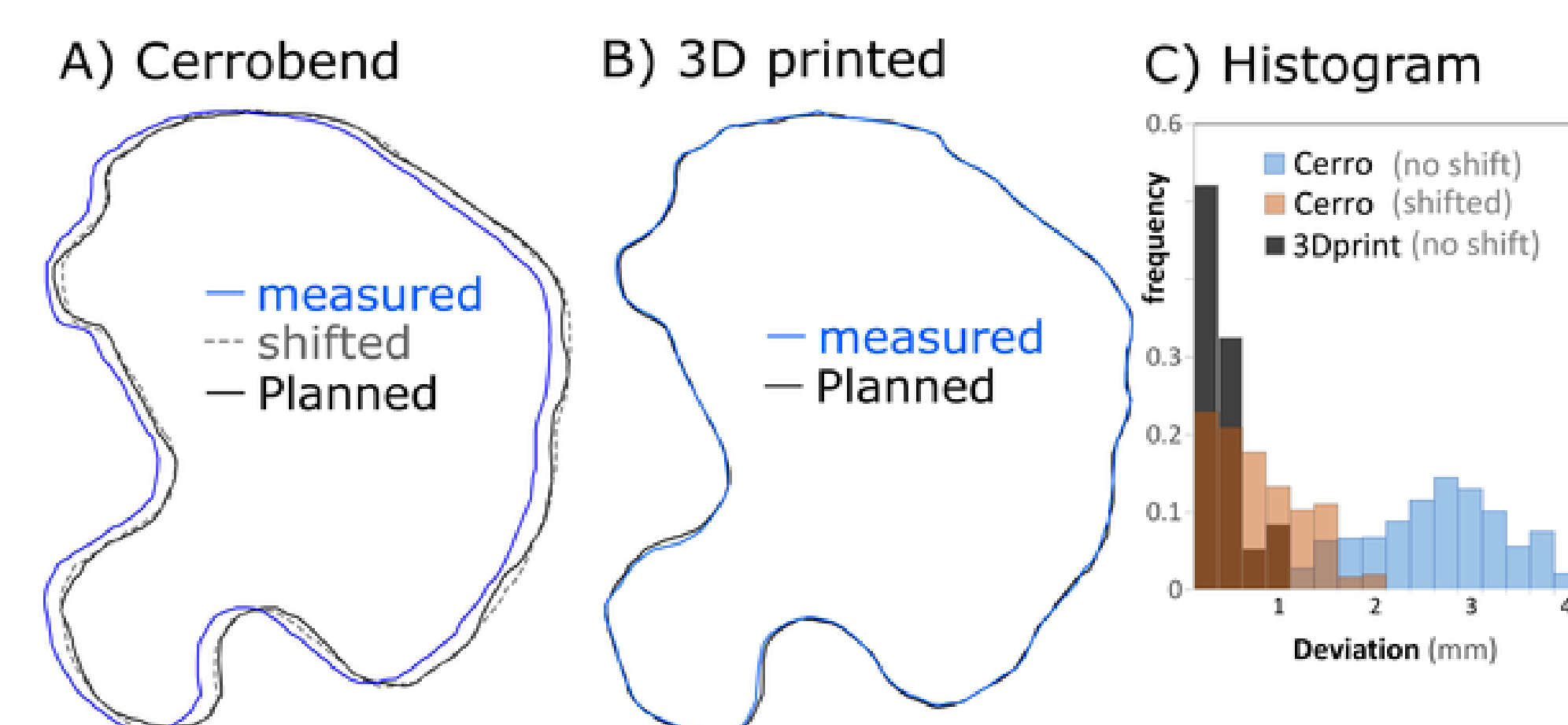
Bolus

Bolus can be described as a material used to act as a layer of human tissue. The material is used for uneven areas of the body such as the ear or nose (Aras, 2020). The bolus acts as layers of skin to cut radiation dose from a part of the body or make that radiation more superficial to the human skin (Aras, 2020). Flexible and conforming, bolus is meant to have little to no air gap between the material and the human skin. This tissue equivalent material is cost effective and flexible for radiation therapists to use.

3D cutouts vs. Cerrobend

Cerrobend alloys, made of lead and cadmium, are used to produce precise cutouts to block beams from targeting good surrounding tissue (Skinner, 2019).

3D printed cutouts have eliminated toxic materials, reduced manual labor, and improved reproduction of the field shape compared to the Cerrobend (Skinner, 2019)



Total Skin Electron Beam Radiation Therapy (TSEBT)

Total Skin Electron Beam Radiation Therapy (TSEBT) is a technique of delivering electron beam radiation to the entire skin surface, typically done standing for a determined amount of time. This is the radiation therapy of choice for widespread disease. To ensure patient safety, the eyes and mouth are shielded, which impairs the patients ability to stay balanced and communicate properly. A new recumbent position has been developed for patients who cannot stand for long periods of time. The recumbent technique is safer, allows for treatment of almost all patients, and provides similar dosimetric and clinical outcomes (Bradley, 2021).

Case Study

The patient was a 25 year old Caucasian male who developed multiple keloids on the upper back and shoulder area. The patient complained of discomfort and embarrassment. A steroid injection of Kenalog was given, which is used to treat different types of inflammatory disorders such as skin disorders. The patient had an excision of a keloid, which reoccurred larger than the original mass. Post-operative radiation was done to control the keloid.

Images

(image below) Keloid post-op



(image on right) Linear accelerator positioning on patients body

(Image below) Patient positioning for electron beam radiation therapy treatment



Conclusion

In conclusion, electron beam radiation therapy can be used for superficial skin lesions, preferred over surgery due to minimal side affects. The radiation dose to deep tissue is minimal. Radiation therapy plays a crucial role in all stages of the disease and can be used in different ways depending on disease extent and responsiveness to other modalities. Electron beam therapy, as of any other radiation treatment can lead to a plummet in mental health. Being cautious of signs of depression is important for patient's going through treatment. Exercise, support groups, and meditation are all ways to help cope with radiation treatment (Memorial Sloan Kettering, 2022). The plethora of different uses electron beam radiation therapy provides demonstrates how much science has evolved and the power radiation therapy has on saving lives.