

Radiotherapy Nerf Gun Demo

Equipment

- Clamp Stand
- Squishy brain on a string as a target which hangs off the clamp stand
- Blindfold
- Nerf gun and pellets
- Face mask if available to demonstrate immobilisation
- Coloured tape to tape off area in front of the table

Safety / Risk assessment notes

The nerf gun pellets are soft, so should not do harm unless they are aimed at the face/eyes (which must not be allowed). As a precaution, keep everyone behind the shooter (behind the “taped” area) so they are out of the path of any pellets.

Background

The idea of this demo is to show how radiotherapy is has improved since its conception so that we can achieve greater conformity of dose to tumour site. The nerf gun represents a linac, firing pellets which represent quanta of radiation. The polystyrene ball represents a tumour. It should have a string through the middle of it and be suspended from the retort stand. For the first parts of the demo, it will need to swing like a pendulum. You will also need to reload the nerf gun between parts of the demo, so it's helpful to have someone on hand to do this during explanations.

The aim is for the shooter to hit the target and get a feel for how easy this is in different situations. Point the shooter at the target, but with a couple of metres separation (keep a fixed distance throughout the demo). You can also say that any misses contribute to the dose of surrounding healthy tissue.

Details

Start with a introduction to cancer , ways of treating it (surgery, chemo and radiation) and explain why some radiation can be good / helpful

- Tell the participants that the medical team want to treat a tumour, then explain the props and what they represents.
- Explain that the body is a dynamic system; breathing, organ motion and patient movement can mean that the tumour also moves
- Start the target oscillating like a pendulum.
- Explain that in the early days of radiotherapy, treatments were delivered with limited knowledge of the tumour's location on that day. Ask the shooter to put on a blindfold.
- With the target oscillating, ask a blindfolded shooter to try and hit the target and try to keep track of how many hits they land.
- Ask how this situation could be improved? Take off the blindfold!
- This now represents Image guided radiotherapy, which allows us to see the location of the tumour prior to treatment, verifying the positioning of the patient and ensuring that no substantial anatomical changes have taken place before treatment delivery.
- Start the target oscillating again and ask a non- blindfolded shooter to try and hit the target and try to keep track of how many hits they land. They should get noticeably more!
- Ask how this situation could be improved even more? Stop the target from moving... Explain how facemasks for example ensure immobilisation (demonstrate the face mask!)
- Stop the target from oscillating.
- Now with a stationary target, ask a non- blindfolded shooter to try and hit the target and try to keep track of how many hits they land. They should do quite well this time!
- Sum up that this represents some of the improvements/developments in radiotherapy that physicists have contributed to.

