

AbstractID: 9103 Title: A Comparison of Proton Modulation with Tumor Location and Energy

Purpose:

To enable a prospective user in proton therapy to estimate the most likely distribution of modulation wheels that will be needed based on energy range and tumor location.

Method and Materials:

In proton therapy, a modulation wheel can be used to create a spread out a Bragg peak (SOBP). Thirteen modulation wheels ranging from 2.6cm to 16.4cm SOBP in water at nearly 1.0cm increments were considered. Data from 622 treatment fields was examined. The data was analyzed based on tumor location (prostates, cranial, and extracranial omitting prostates) and energy (low energy (86-128MeV), medium energy (129-171MeV), and high energy (172-205MeV).)

Results:

Overall, the most commonly used modulation wheels are the 10cm, 9cm, and 8cm wheels accounting for 27%, 18%, and 13% respectively.

For prostates modulation wheels between 8.1cm and 11cm are used most with 41% of prostate patients using the 10cm wheel. Cranial patients use each wheel between 4.1cm and 10cm, excluding 7.1cm, between 11% and 14% of the time. Extracranial cases were treated most frequently with modulation wheels 16.4cm, 10cm, and 8.1cm, which accounted for 22%, 18%, and 14% of cases respectively.

For low energy, the modulation wheels between 4.1cm and 6cm are each used for 15-16% of treated fields. For medium energy fields, with the exception of 7.1cm, the modulation wheels between 5.1cm and 10cm were each used 10%-17% of the time. 41% of high energy fields are treated with a 10cm modulation wheel.

Conclusions:

The 8.1cm, 9cm, and 10cm modulation wheels are most commonly used, comprising 57% of all fields. High energy fields, as well as the prostate and extracranial fields, primarily require modulation from 8.1cm and higher. Medium energy fields mostly use the wheels between 5.1cm and 10cm. Low energy and cranial treatments most often use the modulation wheels from 10cm and lower.