Cureus

Open Access
Abstract

Dosimetric Evaluation and Model Validation of a Novel Couch Insert for Frameless Intracranial Stereotactic Radiosurgery

Karen Snyder [1] , Indrin J. Chetty [1] , Ilma Xhaferllari [2] , Yimei Huang [3] , Bao Zhao [3] , M. Salim Siddiqui, Ning Wen [1]

1. Radiation Oncology, Henry Ford Health System, Detroit, USA 2. Radiation Oncology, Henry Ford Health System 3. Medical Physics, Henry Ford Health System 4.

Corresponding author: Karen Snyder, ksnyder2@hfhs.org

Categories: Medical Physics, Radiation Oncology
Keywords: srs, stereotactic radiosurgery

How to cite this abstract
Snyder K, Chetty I J, Xhaferllari I, et al. (November 02, 2017) Dosimetric Evaluation and Model Validation of a Novel Couch Insert for Frameless Intracranial Stereotactic Radiosurgery. Cureus 9(11): a272

Abstract

Objectives: Common commercially available frameless systems attach as overlays to carbon fiber treatment couches. A novel couch insert, QFix kVue Encompass SRS Insert, consists of two main components, a couch insert and a clam shell style open faced mask that attaches to a U shaped frame raised from the plane of the couch top to provide additional mechanical support. The purpose of this study is to evaluate the dosimetric properties and treatment planning system (TPS) couch model of the SRS couch insert.

Methods: A thermoplastic mask was made for a spherical Lucy 3D phantom and was scanned with and without the insert. Attenuation measurements were performed with and without the insert using a pinpoint ion chamber for energies of 6xFFF, 10xFFF and 6X, with three field sizes (2x2, 4x4, and 6x6 cm2). The percent attenuation was calculated as (1-(DoseInsert/DoseNoInsert))*100. To assess different components of the insert, measurements were broken up into four zones. Zone 1 was the double layered base (Gantry:140-220), Zone 2 the transition zone between the base and the lateral sides (Gantry: 220-235), Zone 3 the lateral sides of the insert (Gantry: 240-262.5) and Zone 4 the area where the mask attaches to the insert (Gantry: 262.5-275).

Results: A Varian provided couch model in the Eclipse TPS (Varian Medical Systems, Palo Alto CA) was aligned and inserted onto the CT image of the Lucy Phantom and the attenuation through the couch model was calculated using the Anisotropic Analytical Algorithm. The calculated and measured percent attenuation was compared. The average percent attenuation measured for the insert in Zones 1-3, for the 6xFFF beam was 3.8%, 3.6%, and 3.4%, for the 10xFFF beam 3.4%, 3.1%, and 2.9% and for the 6X beam 3.6%, 3.4%, and 3.3%, for field sizes of 2x2, 4x4, and 6x6cm2, respectively. The most attenuation occurs in Zone 4, the area where the mask attaches to the insert. The maximum attenuation measured in Zone 4 for the 6xFFF beam was 17.0%, 15.8%, and 15.2%, for the 10xFFF beam 12.7%, 12.3%, and 11.6% and for 6X beam 14.8%, 13.9%, and 13.7%, for field sizes of 2x2, 4x4, and 6x6cm2, respectively. In Zones 1-3, the average difference between measured and calculated attenuation for the 6xFFF beam was 0.13%, 0.16%, and 0.25%, for the 10xFFF beam 0.55%, 0.47%, and 0.50%, and for 6X beam 0.45%, 0.49%, and 0.60%, for field sizes of 2x2, 4x4, and 6x6cm2, respectively. In Zone 4, the average difference between measurement and calculation for the 6xFFF beam was 5.56%, 5.31%, and 5.27%, for the 10xFFF beam 4.45%, 4.33%, and 4.22% and for 6X beam 5.15%, 4.90%,

Open Access
Abstract
Published 11/02/2017

and 4.76%, for field sizes of 2x2, 4x4, and 6x6cm2, respectively. The maximum difference occurred in Zone 4 for all energies and field sizes.

Conclusions: The design of a raised platform used to attach the mask can cause significant attenuation of up to 17%. The vendor provided TPS couch model was able to model the attenuation within 1%, except in zone 4, a 12.5° section where the mask attaches to the insert, where larger discrepancies occurred. Further modifications may be made to the TPS model in order to minimize the differences and experiments at larger field sizes may be necessary to validate the model accuracy.