

Original Article

An Analysis of the Accuracy of the Robotic Respiratory Tracking Radiosurgical System in Extracranial Tumor

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Abstract.

Stereotactic radiosurgery (SRS) has been used to minimize the volume of the surrounding critical structures irradiated during extracranial tumor treatment. The Synchrony™ Respiratory Tracking System (RTS) of the CyberKnife estimates tumor position by building a correlation model between the tumor respiration motion and implanted fiducial markers locations with a predictive algorithm. RTS is able to continuously track the tumor position, anticipate the tumor motion and facilitate real time automatic realignment of the radiation beam. A ball cube phantom with preloaded fiducial markers and Gafchromic films was used in this study to verify the accuracy of the Synchrony™ RTS in real-time tracking of moving thoracic tumor. Three stages of respiratory tracking were tested, including static, motion and compensation experiment. The systemic errors of targeting with Synchrony™ RTS switch off and moving phantom located in the center, end expiration and end inspiration respiratory cycle were 0.76 ± 0.14 mm, 10.86 ± 0.29 mm and 11.16 ± 0.45 mm, respectively. With Synchrony™ RTS switch on, the errors were 0.33 ± 0.13 mm, 0.42 ± 0.66 mm and 0.30 ± 0.66 mm, respectively. There was no significant accuracy difference between taking x-ray images at every node or every four-node interval. By using the Synchrony™ RTS to build nonlinear correlation models of inspiratory and expiratory phases of the respiratory cycle, simultaneous real-time tracking of the thoracic tumor position in all three directions can achieve sub-millimeter accuracy.

Keywords : CyberKnife, Respiratory Tracking System

原著論文

機械手臂呼吸追蹤系統運用在顱外腫瘤之立體定位放射線手術治療之準確性分析

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