

Abstract

This project focuses on the implementation of AlignRT, a surface-guided radiation therapy (SGRT) system, and its impact on improving precision, safety, and efficiency in radiation therapy. AlignRT uses real-time 3D surface imaging to monitor patient positioning and detect motion throughout treatment, allowing for accurate and consistent radiation delivery. This study examines how AlignRT enhances clinical workflows by reducing the need for permanent skin markings and limiting additional imaging, ultimately decreasing unnecessary radiation exposure to patients. Emphasis is placed on its role in high-precision treatments such as stereotactic body radiation therapy (SBRT), where even small positional errors can significantly affect outcomes. AlignRT's ability to automatically pause treatment when motion exceeds set treatment parameters and its compatibility with breath-hold techniques also contribute to improved targeting and protection of surrounding healthy tissue. Findings from this project demonstrate that AlignRT improves setup accuracy, reduces treatment time, and increases patient treatment accuracy. While limitations such as cost and inability to track internal anatomy remain, the integration of AlignRT is a major advancement in radiation therapy.

Keywords: radiation therapy, AlignRT, surface-guided radiation therapy, stereotactic body radiation therapy, patient positioning