u!nnovation.

UNITED IMAGING



Global Spread of external contributors



Foreword

A Note from the Editorial Board

Welcome to this year's annual magazine from the Global Scientific Collaboration team.

uInnovation is a scientific magazine published by United Imaging Healthcare that has been successfully distributed for over past three years. It aims to serve as a platform for sharing ground-breaking advancements, emerging trends, and future possibilities in the vast expanse that is oncology.

uInnovation is currently in its fourth edition. This year's edition will inform, engage, and inspire you about the latest developments and applications of United Imaging Healthcare. This journal includes quick read sections for those in a rush, and appealing images to promote visual understanding.

United Imaging Healthcare is a provider of high-end medical equipment and medical IT solutions. From our headquarters in Shanghai's Jiading district to our network of research and development centers throughout the world, our global mission is to provide medical institutions with a full range of healthcare solutions, from diagnostic imaging and radiation therapy equipment to service, training, and medical IT solutions.

We are dedicated to expanding access to high-quality medical care and improving the value of our services.

VISION —— Leading Healthcare Innovation

MISSION —— To Bring Equal Healthcare for All

To learn more, visit https://www.united-imaging.com/

Disclaimer

The articles contained in this magazine are provided solely by the authors, and the author(s) of each article appearing in this magazine is/are solely responsible for the content thereof as well as personal data, which is used anonymously or complied with applicable data privacy laws or regulations. United Imaging Healthcare makes no representation or warranties, expressly or impliedly, with respect to the accuracy, timeliness, reliability, legitimacy, applicability, fitness, originality, or completeness of the contents of this magazine. United Imaging Healthcare assumes no legal responsibility or liability for any error, omission, or illegality with respect to the material contained within.

All articles contained in this magazine only represent the opinions and views of the authors and do not implicitly or explicitly represent any official positions or policies, or medical opinions of United Imaging Healthcare or the institutions with which the authors are affiliated unless this is clearly specified. Discussions of any brand, services, or products in the magazine should not be construed as promotion or endorsement thereof.

Articles published in this magazine are intended to inspire further general scientific research, investigation, understanding, and discussion only and are NOT intended to and should not be relied upon as recommending or promoting a specific medical advice, method, diagnosis, or treatment by physicians for any particular individual, nor to replace the advice of a medical doctor or other healthcare professional. Any individual wishing to apply the information in this magazine for the purposes of improving their own health should not do so without consulting with a qualified medical practitioner. All patients need to be treated in an individual manner by their personal medical advisors. The decision to utilize any information in this magazine is ultimately at the sole discretion of the reader, who assumes full responsibility for any and all consequences arising from such a decision. United Imaging Healthcare makes no representations or warranties with respect to any treatment, action, or application of medication or preparation by any person following the information offered or provided within or through the magazine. United Imaging Healthcare shall remain free of any fault, liability, or responsibility for any loss or harm, whether real or perceived, resulting from the use of information in this magazine.

The articles included in this magazine may contain work in progress, which represents ongoing research and development. Such technologies are not available for sale in the United States for clinical use and also may not be available for such sales in other countries around the world.

Please note that the magazine is intended to be distributed only within a limited scope instead of publication.

If you have any questions about the magazine, or simply wish to reach out to us for any other reasons, you are welcomed to contact us at the following email address: compliance@united-imaging.com

All-in-One Radiotherapy：An AI-driven journey from simulation to treatment

Zhen Zhang[a], Guanqun Zhou[b] , Jingjie Zhou

[a] Department of Radiation Oncology, Fudan University Shanghai Cancer Center, CHINA

[b] Department of Radiation Oncology, Sun Yat-sen University Cancer Center, State Key Laboratory of Oncology in South China, Collaborative Innovation Center for Cancer Medicine, Guangdong Key Laboratory of Nasopharyngeal Carcinoma Diagnosis and Therapy, Guangzhou, CHINA

The Challenge

For decades, radiotherapy workflow has been a multi-step and resource-intensive process. What the patient faces is a fragmented journey: a visit for a CT Simulation, then days, or even weeks, of anxious waiting while radiation oncologists and physicists design complex treatment plans through steps including contouring, planning, evaluation and quality assurance. Only after this lengthy delay can the first treatment be delivered.

This waiting duration is agonizing for patients and their families, who are desperate to begin fighting the disease. Clinically, the delay is also problematic. A patient's anatomy can change, tumors can progress, and the plan created based images acquired a week ago may no longer be perfectly optimized for the day of treatment. The current workflow also poses economic burden for patients who travel long distances to the hospital.

The Technology

Many technical advances have been introduced to improve the efficiency of individual tasks during the radiotherapy workflow, such as auto segmentation and auto planning. In 2018, the world's first integrated CT-guided linear accelerator, uRT-Linac 506c was released, which provided the platform for the fully streamlined automation of the entire radiotherapy workflow. A unique approach called "All-in-One" radiotherapy workflow was co-developed by researchers from Fudan University Shanghai Cancer Center (FUSCC) and UIH. This approach redesigns the entire process around a single, seamless session using two core technological advancements:

- *Integrated Diagnostic-Quality CT:* The system is built on a hybrid machine that combines a diagnostic-quality CT scanner with a state-of-the-art linear accelerator (LINAC). This allows for both high-fidelity imaging and precise treatment delivery to happen on the same couch, eliminating the need for patient transport and re-positioning.
- *An Intelligent AI Engine:* This is another cornerstone of this workflow. An AI copilot is seamlessly integrated into the workflow, as soon as the CT scan is complete, AI copilot performs two critical tasks in minutes:
  - Auto segmentation: It instantly and accurately outlines the tumor and all nearby healthy organs (known as organs-at-risk).
  - Auto planning: It generates a high-quality, clinically optimal radiation plan tailored to the patient's specific anatomy.

The workflow is entirely automated, incorporating embedded QA solutions to ensure safety and precision at every stage. Users have the flexibility to choose from EPID transit QA and independent dose calculation QA to further validate the process. Strategically placed human checkpoints—including contour review, plan evaluation, IGRT verification, and QA approval—are seamlessly integrated into the workflow. This design allows for streamlined, single-visit completion, with the patient remaining on the treatment couch throughout the entire process. This approach minimizes delays, enhances efficiency, and ensures a high standard of care. The streamlined workflow improves efficiency of RTx preparation, minimizing patient waiting and hospital visit costs.

Did that work?

Yes, the results have been transformative. The "All-in-One" workflow was first pioneered at Fudan University Shanghai Cancer Center (FUSCC) on rectal cancer patients, proving the concept was feasible and could reduce the entire process to just 23 minutes.



Figure 1. Concept of the All-in-One solution



Figure 2. The World's First Integrated CT-Linac#.

#No 510k application for uRT-Linac 506c has been filed with the FDA. This product is not available for sale in the U.S. for clinical uses and also may not be available for sales in other countries.



Figure 3. Fan-Beam CT Provides Diagnostic-Level Image Quality.

An example is CT image shown in Figure 3, the quality of this CT rivals that of a CT Simulator scan. This is made possible by the design of the integrated, on-board fan-beam CT (Figure 2). The superior soft tissue contrast, free from air cavity artifacts, provide clinicians with high confidence in target contouring and direct dose calculation, capabilities often limited by the poor contrast of conventional CBCT. An integrated EPID is provided to perform online transit dose verification, the γ passing rate result, shown in Figure 4, indicates that the All-in-one technique is not only safe, but also by minimizing the delay between the CT simulation and the first treatment, the system ensures that the treatment plan accurately reflects the patient's current anatomy, reducing the impact of systematic changes like tumor growth or weight fluctuation.

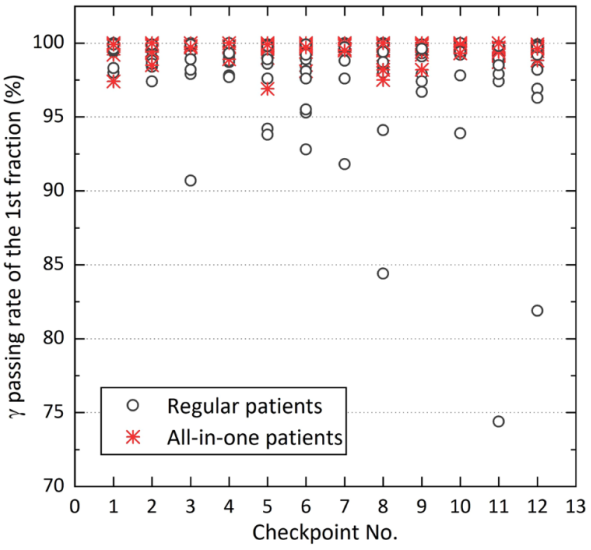


Figure 4.γ-passing rate of in vivo QA for the All-in-One patients (red star) and regular patients (black circle) during the first treatment. [1]

Building on this, Sun Yat-sen University Cancer Center (SYSUCC) has expanded the horizon of this technology significantly by demonstrating its feasibility on patients with nasopharyngeal carcinoma (NPC), one of the most complex cancers to treat due to its proximity to the brain and optic nerves. In a prospective study involving 120 patients, they found the AI-powered workflow to be a resounding success. The median time from the initial scan to the completion of the first treatment was only 23.2 minutes [2].

Most importantly, the quality of care was exceptional. The AI-generated plans were of high quality, an impressive 92% of plans met clinical requirements after a single optimization, a significant acceleration compared to the 4 to 6 rounds typically needed for manual plans. The clinical outcomes were outstanding, with 99.1% of patients achieving a complete tumor response at their 12-week follow-up along with a favorable acute toxicity profile. This large-scale validation proves the technology is not only incredibly fast but also safe and clinically powerful, even for the most challenging cases.

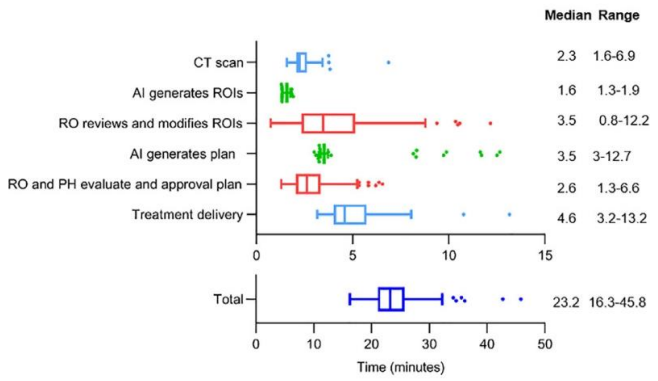


Figure 5. Overview of the MSI Workflow Time Spent. The workflow is color-coded: green steps represent AI-executed processes, red steps indicate manually performed tasks, and blue steps correspond to other processes. [2]

Author's statement:

For too long, the radiotherapy process has been fragmented, forcing patients to endure a lengthy and anxious wait between simulation and treatment. Our work demonstrates that by integrating smart hardware and AI, we can collapse this timeline from days into minutes. This isn't just about efficiency; it's about providing immediate, high-quality care, reducing patient uncertainty, and creating a more humane and responsive treatment experience from day one.

So What?

The validation of the All-in-One workflow by two domestic leading cancer centers marks a pivotal moment in radiation oncology. For patients, the benefit is immediate and profound: less waiting, less anxiety, and the start of treatment without delay. For hospitals, it represents a dramatic increase in efficiency, allowing them to treat more patients and focus expert resources on the most complex cases. In addition, the All-in-One workflow facilitates time-sensitive clinical trials where prompt radiotherapy treatment initiation is critical. Furthermore, it enables novel paradigms like Pulsar therapy, which can induce dramatic anatomical changes that overwhelm online adaptive radiotherapy. By providing rapid, integrated re-planning capabilities, the AIO platform offers a viable solution for managing these significant intra-treatment variations and advancing such innovative therapeutic strategies.

References:

[1] Yu L, Zhao J, Xia F, et al. (2023) Technical note: First implementation of a one-stop solution of radiotherapy with full-workflow automation based on CT-Linac combination. Medical Physics.

[2] Yang YX, Yang X, Jiang XB, et al. (2025) Artificial Intelligence-Empowered Multistep Integrated Radiation Therapy Workflow for Nasopharyngeal Carcinoma. International Journal of Radiation Oncology*Biology*Physics.

Authors Biography



Dr Zhen Zhang, MD
Director at the Department of Radiation Oncology,
Fudan University Shanghai Cancer Center,
CHINA

Dr. Zhen Zhang is a Professor and the Chair of the Department of Radiation Oncology at Fudan University Shanghai Cancer Center, where she specializes in gastrointestinal (GI) cancers. She completed her MD at Shanghai Medical University (now part of Fudan) and later earned a PhD in Oncology from Fudan University (2004–2007). Dr. Zhang also trained internationally, having been a clinical observer in the Radiation Oncology Department at MD Anderson Cancer Center in Texas. Her research has focused on chemoradiation strategies for rectal cancer, biomarkers (like COX-2) to predict radio sensitivity, and the use of advanced imaging in head-and-neck and abdominal radiotherapy.



Dr Guanqun Zhou
Department of Radiation Oncology, Sun Yat-sen University Cancer Center, State Key Laboratory of Oncology in South China, Collaborative Innovation Center for Cancer Medicine, Guangdong Key Laboratory of Nasopharyngeal Carcinoma Diagnosis and Therapy, Guangzhou, CHINA

Dr. Guanqun Zhou, MD, PhD, is a radiation oncologist at the Department of Radiation Oncology, Sun Yat-sen University Cancer Center (SYSUCC) in Guangzhou, China. She specializes in treating head and neck cancers, particularly nasopharyngeal carcinoma. Dr. Zhou is also active in academic research, leading work on online adaptive radiotherapy (ART) using integrated CT-guided platforms, showing feasibility and dosimetric benefits for NPC. Her research contributions include studies on AI-driven planning, deep learning segmentation of tumor volumes, and the dynamics of tumor/organ changes during radiotherapy.

PASSION for CHANGE

©2025 United Imaging Healthcare Co., Ltd. All rights reserved.

If you have any questions about the magazine, or simply wish to reach out to us for any other reasons, you are welcome to contact us at the following email address: compliance@united-imaging.com