

Introduction

With the advent of modern radiotherapy (RT) techniques such as External Beam Radiation Therapy (EBRT) and Intensity Modulated Radiation Therapy (IMRT), it has allowed more effective treatment of patients with head and neck cancer. Nonetheless, numerous adverse effects of RT still persist among patients including xerostomia, oral mucositis, osteoradionecrosis, taste changes, trismus, and radiation-related caries.¹

Intraoral stent for radiotherapy (IS-RT) is an effective tool to aid the patient undergoing arduous RT due to its significant benefits. This customized device can reduce the variation and ensure precision in radiation dose between each fraction by providing a stable and reproducible patient position.² It also ensures more precise pre-irradiation planning and preserves surrounding healthy tissues from inadvertent irradiation.³

Despite the evident benefits of IS-RT, there is a lack of consensus on its design and fabrication. In fact, various forms exist to serve multiple functions such as immobilization of the mandible and depression of the tongue.

Various Forms of IS-RT



Figure 1 (A) Generic positioning stent with thermoplastic sheet; (B) Customized positioning stent with tongue depressing blade; (C) Tongue deviating stent

Case History

A 26 y/o female patient diagnosed with nasopharyngeal carcinoma presented to the Postgraduate Prosthodontics clinic at Stony Brook University School of Dental Medicine with a referral from a radiation oncologist, for a pre-radiation dental consultation and to provide a mouth opening-tongue depressing intraoral stent to be used during Intensity-Modulated Radiation Therapy (IMRT). Initial appointment revealed clinical findings such as maximum mouth opening of 40mm, fully dentate maxilla, and mandible with no signs of caries or pathologies.

Techniques / Steps / Photos



Figure 2. (A) Maximum mouth opening; (B) Biting jig prepared at the two-thirds of maximum mouth opening; (C) Scanning interocclusal record

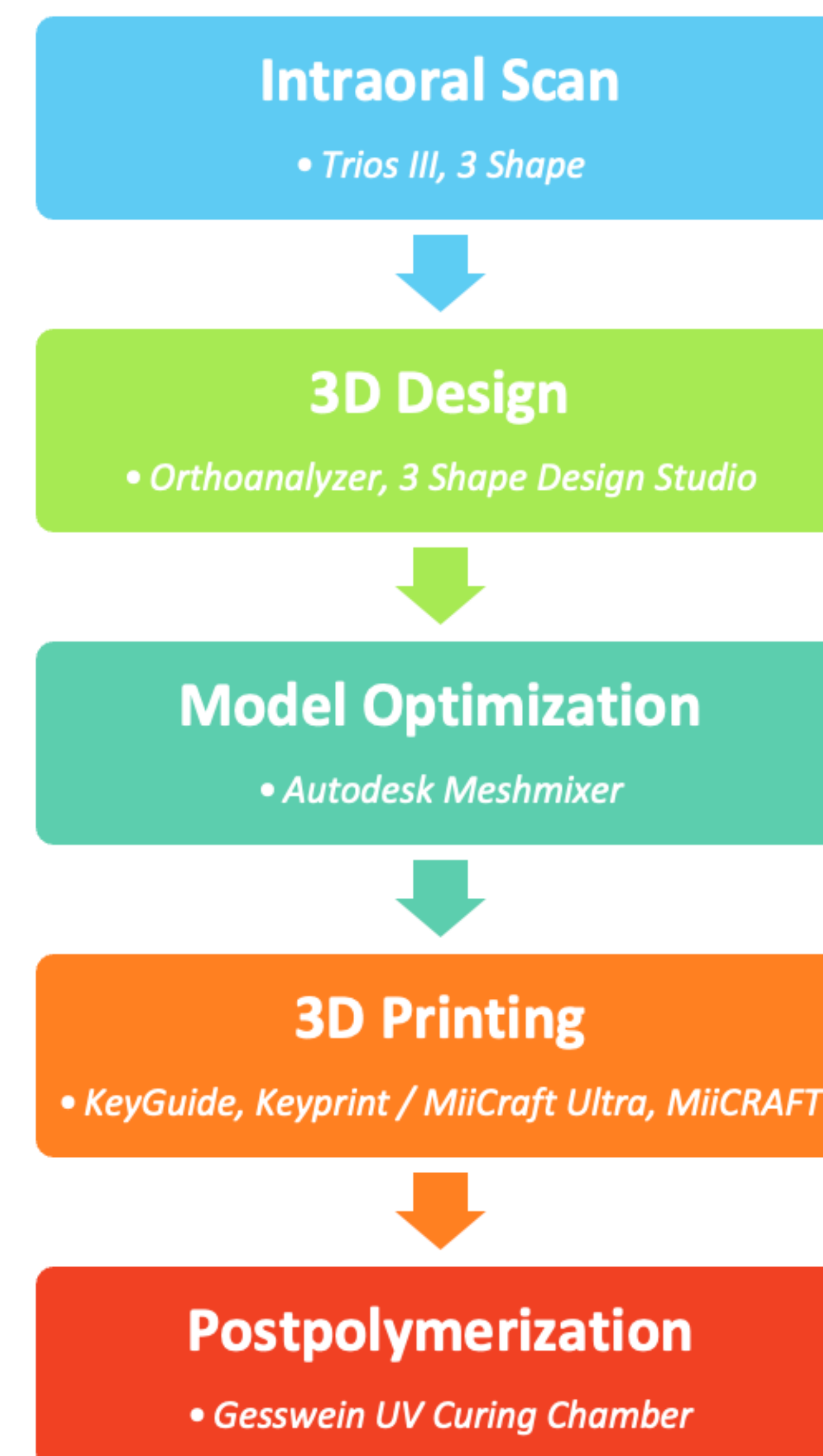


Figure 3. Digital Workflow of designing and fabrication of IS-RT

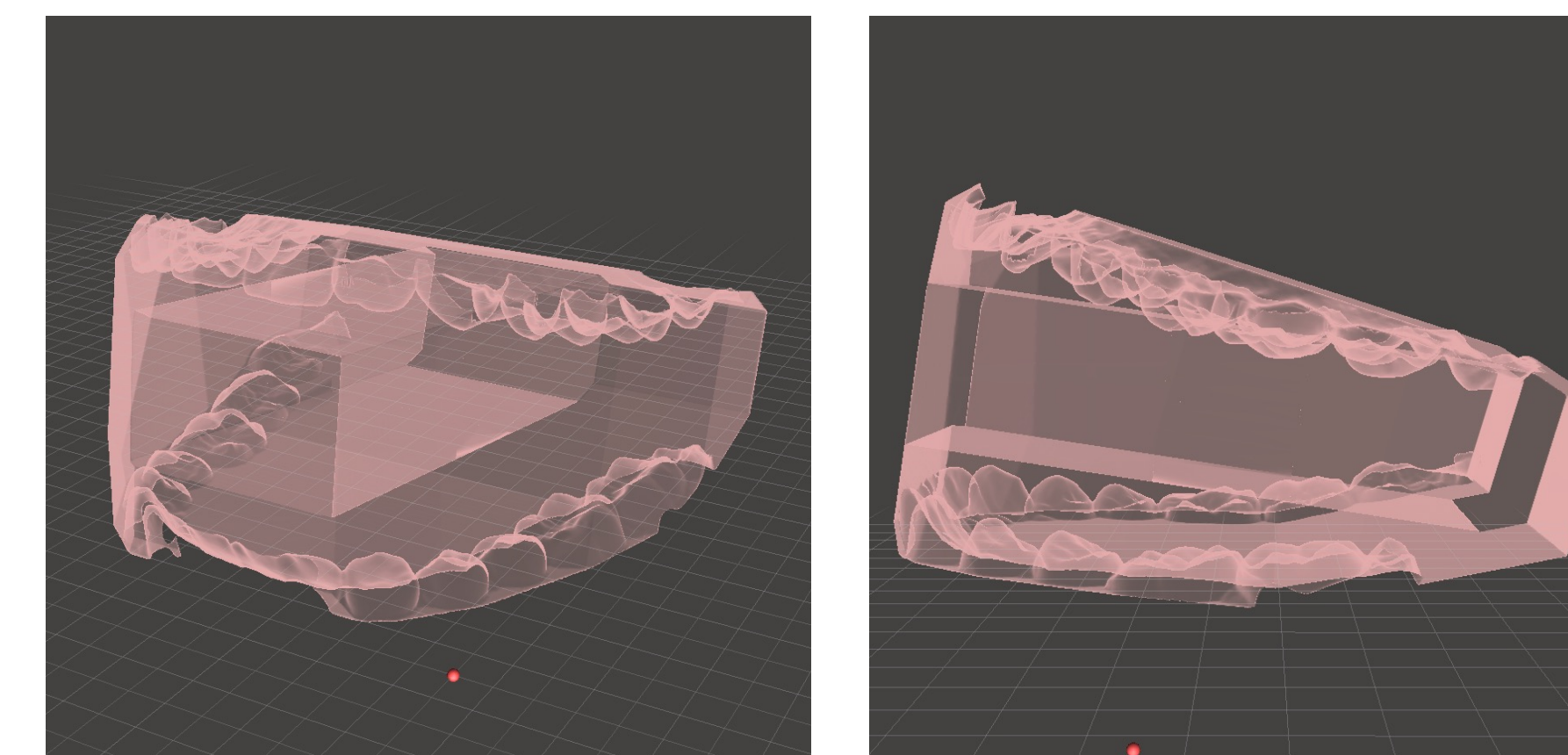


Figure 4. (A) Digitally designed 3D model; (B) 3D Printed Model on the printed diagnostic cast

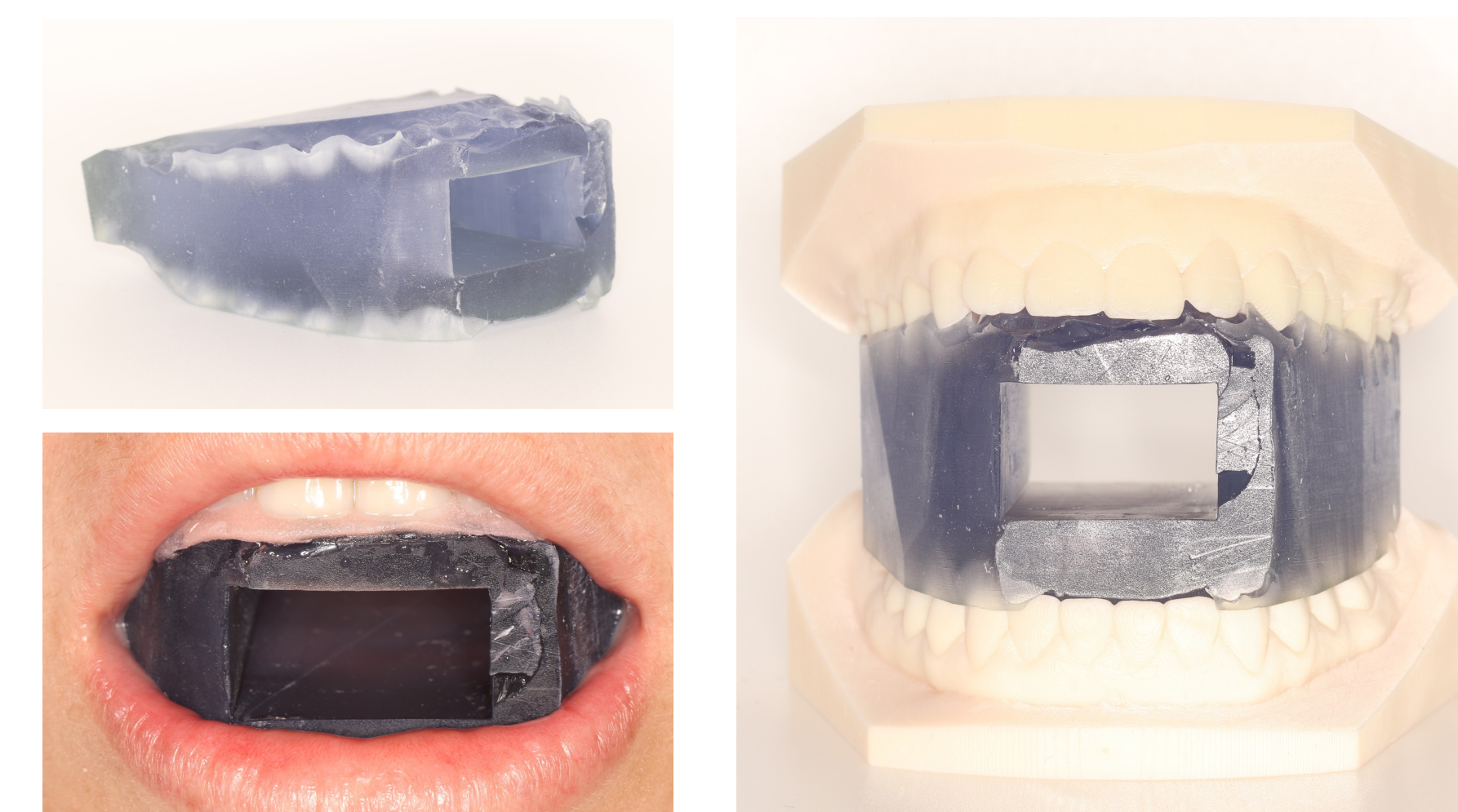


Figure 5. (A) 3D Printed Intraoral Stent; (B) Frontal view of patient wearing intraoral stent; (C) Intraoral Stent placed on the printed diagnostic model

Clinical Relevance

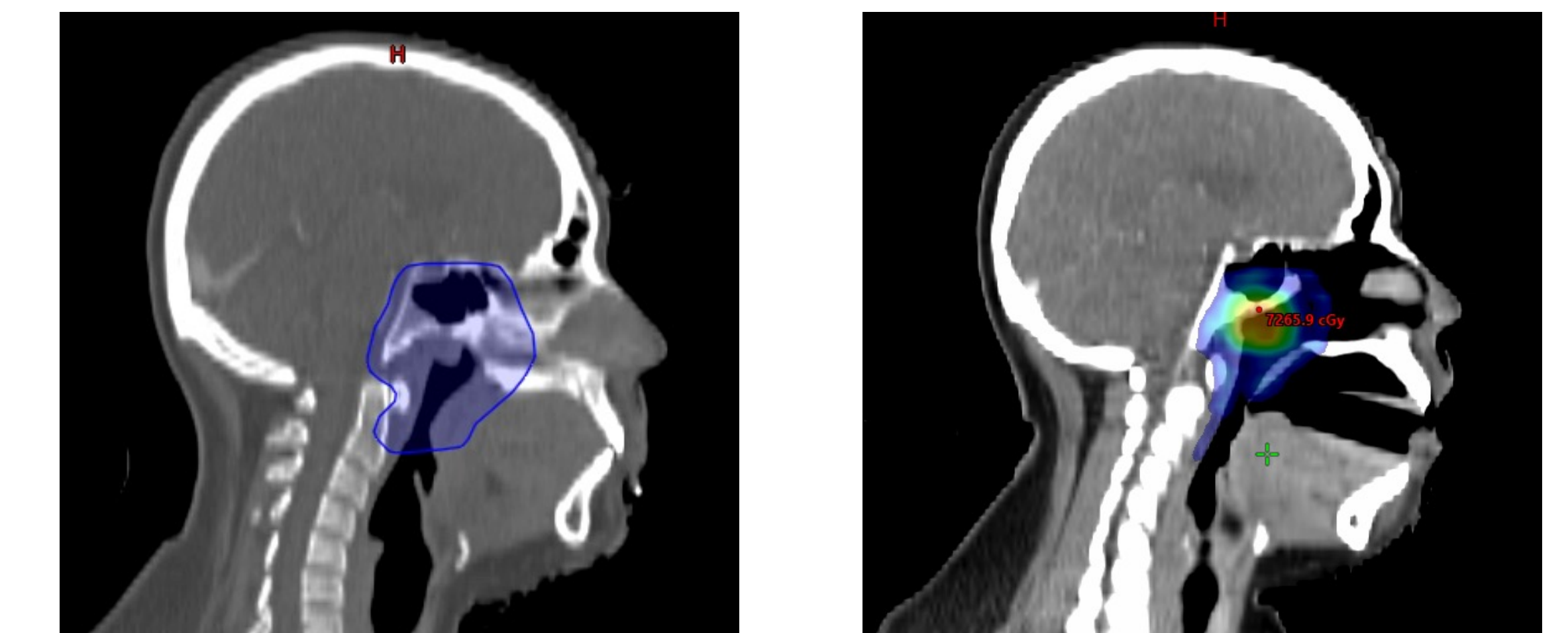


Figure 6. Radiation dosage mapping (A) without intraoral stent (B) with intraoral stent

Radiation dosage maps, as shown in Figure 6, indicate that there is a higher dose going to the tongue without the stent in place. The current finding has been supported by previous literature that evaluated the benefits of intraoral stents in patients subjected to head and neck radiotherapy. *Verrone* reported in his retrospective cohorts study, a significant dose reduction in healthy tissues for the patients with cancers on the mandible treated using IS-RT.³ With regards to the occurrence and degree of complications associated with radiotherapy, *Goel* suggested a reduction of the incidence or severity of oral mucositis, trismus, and xerostomia among patients who used intraoral stent during RT treatment.⁴

Digital workflow with 3D printing techniques has led to more efficient designing and fabrication of IS-RT. CAD software and 3D printing are useful for handling unexpected patient conditions as it allows modification and refabrication within a half day if the device does not fit the patient.⁵

Several evident challenges exist in the current workflow. A complete digital workflow possessing the potential risk of dimensional inaccuracy during image rendering led to an extended chairside adjustment of the prosthesis. Incomplete seating of the prosthesis could be attributed to limitations in the accuracy of digital impression and 3D printing technology.

Pre-radiation prosthodontic consultation requires timely coordination between the radiation oncologist, the patient and the prosthodontist. With an adequate understanding of the indication and various forms of IS-RT, every measure of precaution must be taken to provide the patient with the most comfortable and predictable outcome to prevent complications associated with RT in the head and neck region.

References

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