



University of Colorado

# Novel 3D-Printed Ceramic RBFDP for Tooth Restoration: Case Report

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## Introduction

Resin Bonded Fixed Dental Prostheses (RBFDPs) offer a minimally invasive and esthetically pleasing solution for tooth replacement, with precise connector design being essential for long-term success. Studies have shown that undersized connectors may lead to fractures and oversized ones can impact esthetics and periodontal health. Recent advancements in additive manufacturing and 3D-printed ceramic materials provide enhanced mechanical properties. Advances in 3D-printed ceramic materials offer improved mechanical properties, making them a viable option for select clinical applications.

## Chief Complaint

The patient's chief complaint was, "I need something fixed for my front teeth. I do not want any surgery. I want to avoid grinding any of my teeth. I am considering an implant later."



## Oral Status

A 73-year-old female patient with a history of traumatic injury, including the loss of tooth #9 and bilateral temporomandibular joint (TMJ) dislocation due to a car accident, presented seeking a fixed tooth replacement. The patient presented with an anterior open bite and horizontal overlap by 5mm. She had previously worn an Essix retainer with a pontic during the healing process following multiple surgeries.

## Treatment Plan Summary

Due to the patient's severe anterior open bite following TMJ fixation surgery, an RBFDP was proposed as a minimally invasive, interim solution. The patient opted for a long-term provisional #9 restoration until she was ready for a definitive treatment plan.

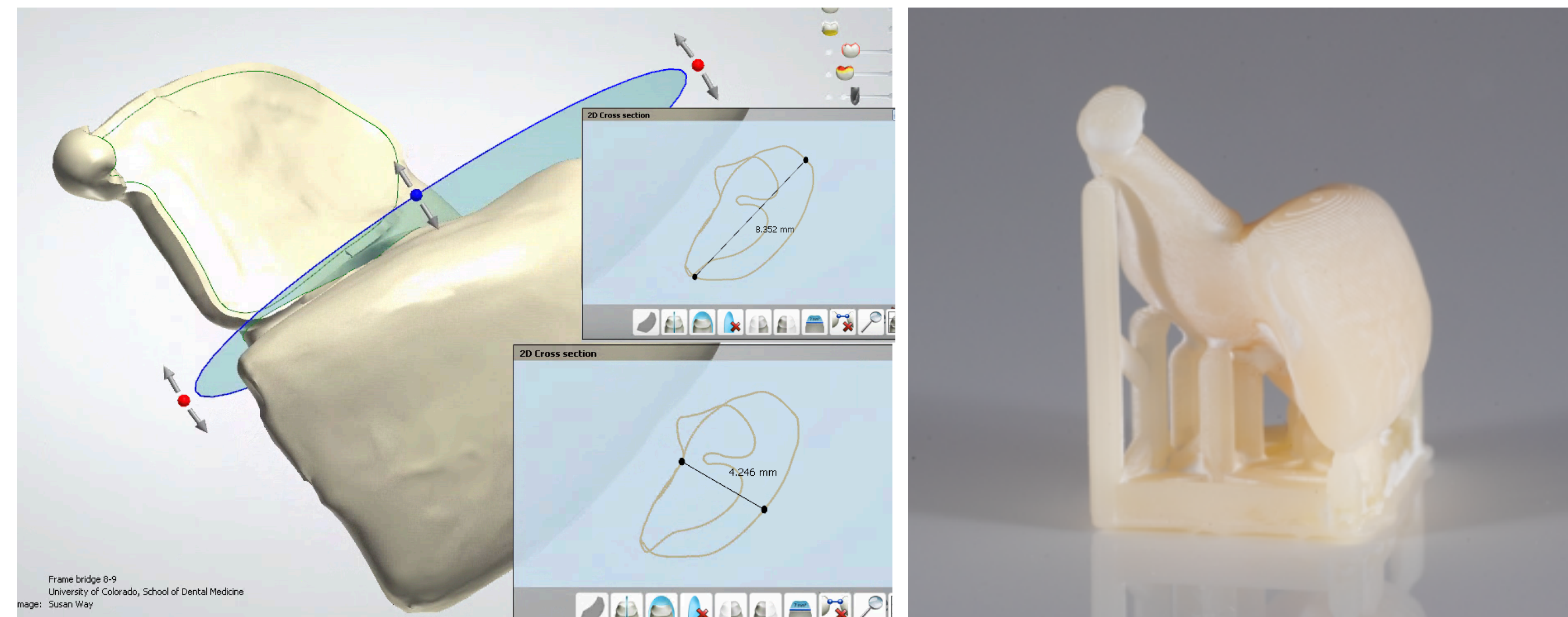
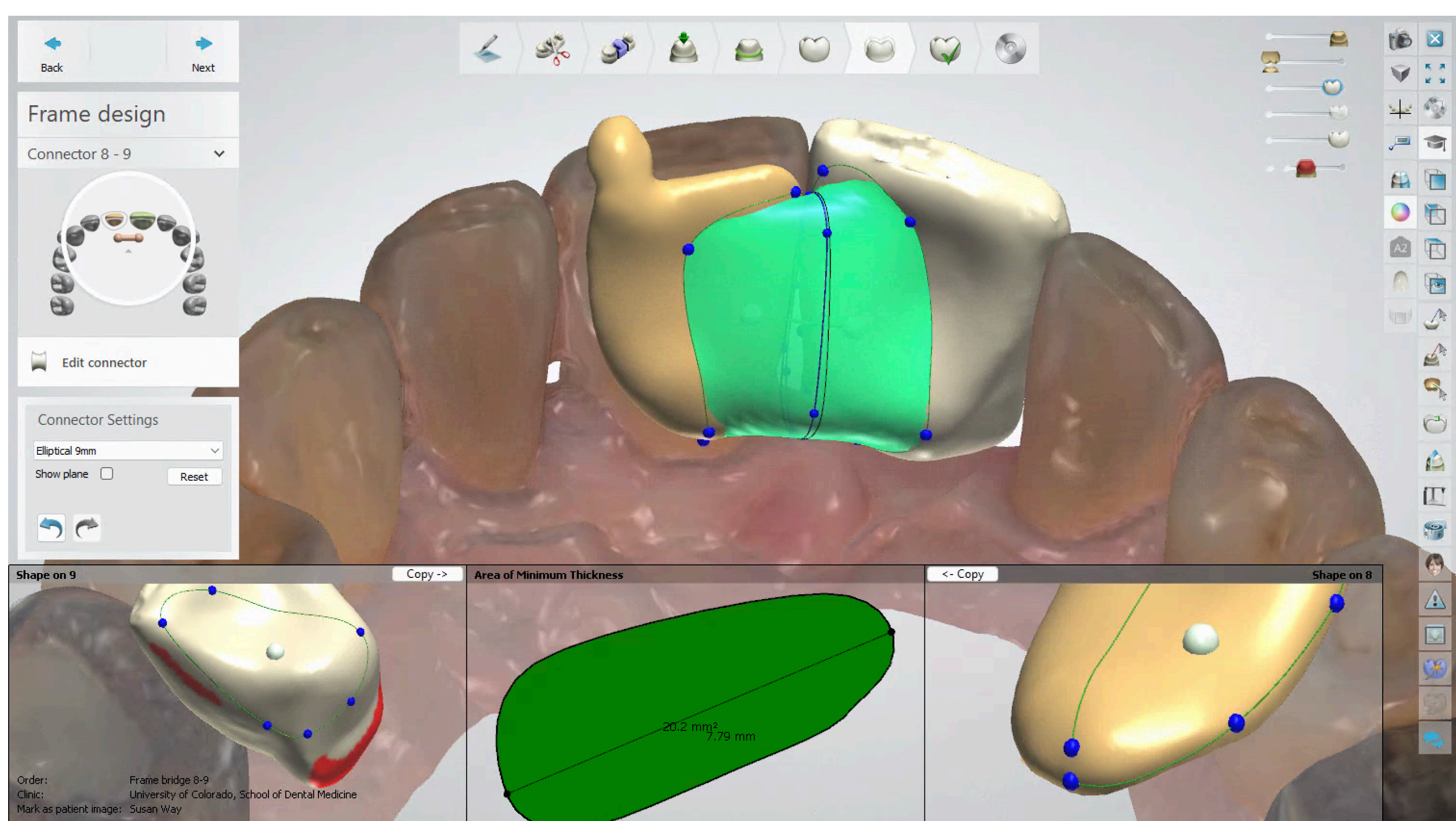
## Therapy

Digital impressions were taken using the intraoral scanner (Trios 5; 3Shape), followed by shade selection and intraoral photography. The pontic was digitally designed in digital software (Dental System; 3Shape) by mirroring tooth #8. Connector dimensions were calculated based on the material's biomechanical properties to ensure structural integrity while maintaining esthetics. Given the lower flexural strength, the cross-sectional area should be increased by a factor of  $\sqrt{2}$  (~1.41x) for comparable performance.

$$A_2 = A_1 \times \sqrt{\frac{\sigma_1}{\sigma_2}}$$

- $A_1 = \text{cross-sectional-area(LD)}$
- $A_2 = \text{cross-sectional-area(PrintedCeramic)}$
- $\sigma_1 = \text{Flexuralstrength(LD)}$
- $\sigma_2 = \text{Flexuralstrength(PrintedCeramic)}$

Material	Height (mm)	Width (mm)	Cross-Sectional Area (mm <sup>2</sup> )
Lithium Disilicate	5.0	3.5	17.5
Printed Ceramic	5.9	4.2	24.7



Completed design is exported to STL file and printed with printed ceramic material (Ceramic Crown; SprintRay) by 3D Printer (Midas; SprintRay), then washed with 91% Isopropyl alcohol followed by curing (Nanocure; SprintRay). Finished and polished based on the manufacturer's guide with crosscut carbide bur, silicone wheel (Opragloss spiral wheel; Ivoclar vivadent), goat hair brush followed by buffing wheel. The restoration then was custom stained with custom shading material (Empress Direct Color; Ivoclar vivadent).

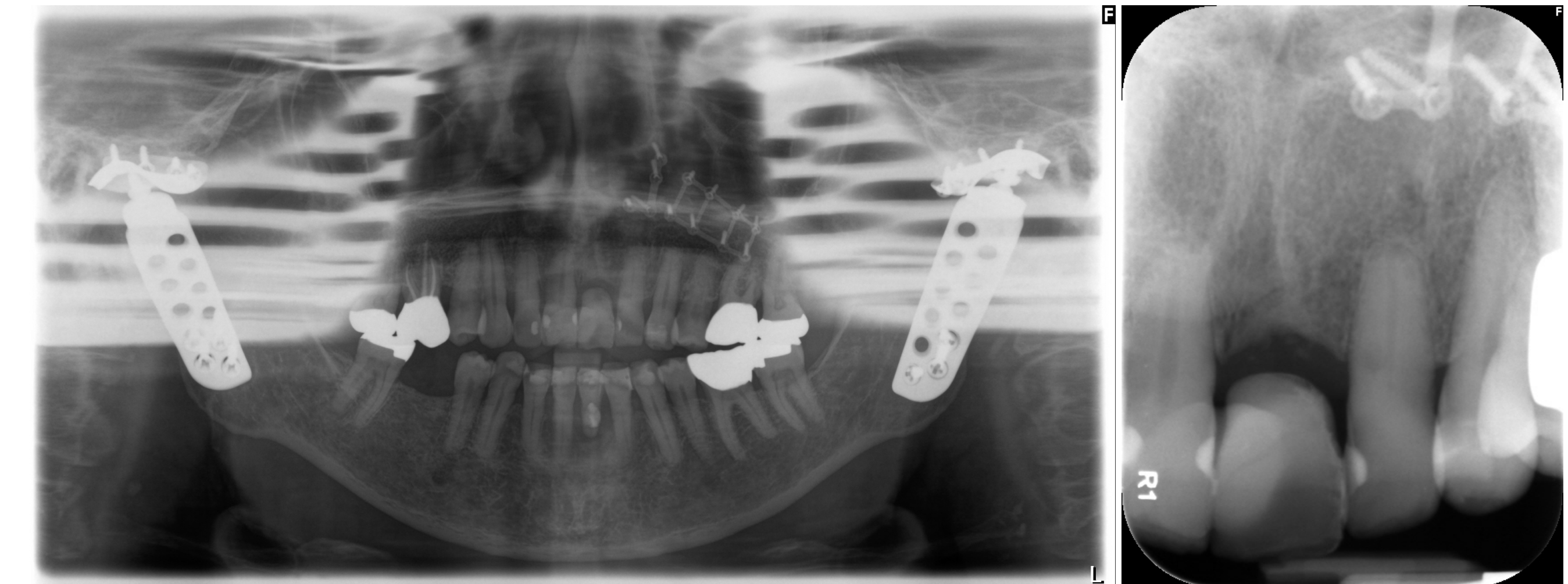


Restoration surface is air-abraded with aluminum oxide (50micron) particles at 1bar. Bonding agent (Adhese universal; Ivoclar Vivadent) applied for 20sec with air thinning until immobile layer achieved.

Palatal surface of #8 is etched with 35% phosphoric acid for 30sec, rinsed and air-dried, bonding agent scrubbed for 20sec, air thin until immobile layer achieved followed by light curing for 10sec.

Cemented with resin cement (Variolink esthetic Neutral; Ivoclar Vivadent) seated, tack cured, cleaned excessive cement for 3 sec with curing light, removed all the excess cement. Fully cured for 10 sec each surface and polished all the margins to remove any excess cement.

Confirmed the occlusion with open bite, no occlusal contact on any excursive, protrusive movements. Radiographs and photographs taken at the most recent post-treatment follow up (4 months).



## Clinical Significance of Therapy/Summary

This case emphasizes the significance of precise connector design in achieving successful case outcomes. Additionally, it highlights the potential of 3D-printed ceramic materials in improving the performance of RBFDPs, as advancements in additive manufacturing continue to enhance their mechanical properties.

## Reference

For related articles and references, kindly scan the QR code in the corner.

