



A NOVEL EXTERNAL COOLING SYSTEM FOR STATIC COMPUTER-AIDED IMPLANT PLACEMENT (SCAIP): TWO CLINICAL CASE REPORTS

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INTRODUCTION

Edentulism and terminal dentition remain major challenges in prosthodontics, often requiring implant rehabilitation to restore function and quality of life. When implants are placed immediately after extraction or in the presence of irregular alveolar bone, bone reduction may be necessary to create sufficient space for restorative purposes. One critical factor during implant osteotomy preparation is thermal control. Temperatures above 47°C for more than one minute can cause bone necrosis, impair osseointegration, and compromise implant survival. Traditional irrigation methods may be insufficient, especially with static computer-aided implant placement (sCAIP) guides, where drill access is restricted. To address this limitation, a novel external cooling irrigation system was integrated into the surgical guide design. This modification enables continuous and effective cooling at the drilling interface, helping to prevent overheating and reduce trauma to both hard and soft tissues.

CASE HISTORY

CASE 1:

A 65-year-old Hispanic female with maxillary complete edentulism and mandibular partial edentulism, with remaining mandibular anterior canines, patient presented to the postgraduate prosthodontics clinics at Rutgers School of Dental Medicine, Newark, NJ, USA, in July 2022. Her chief complaint is “My lower denture is not stable anymore, and my upper denture keeps falling while I am eating with both dentures.”

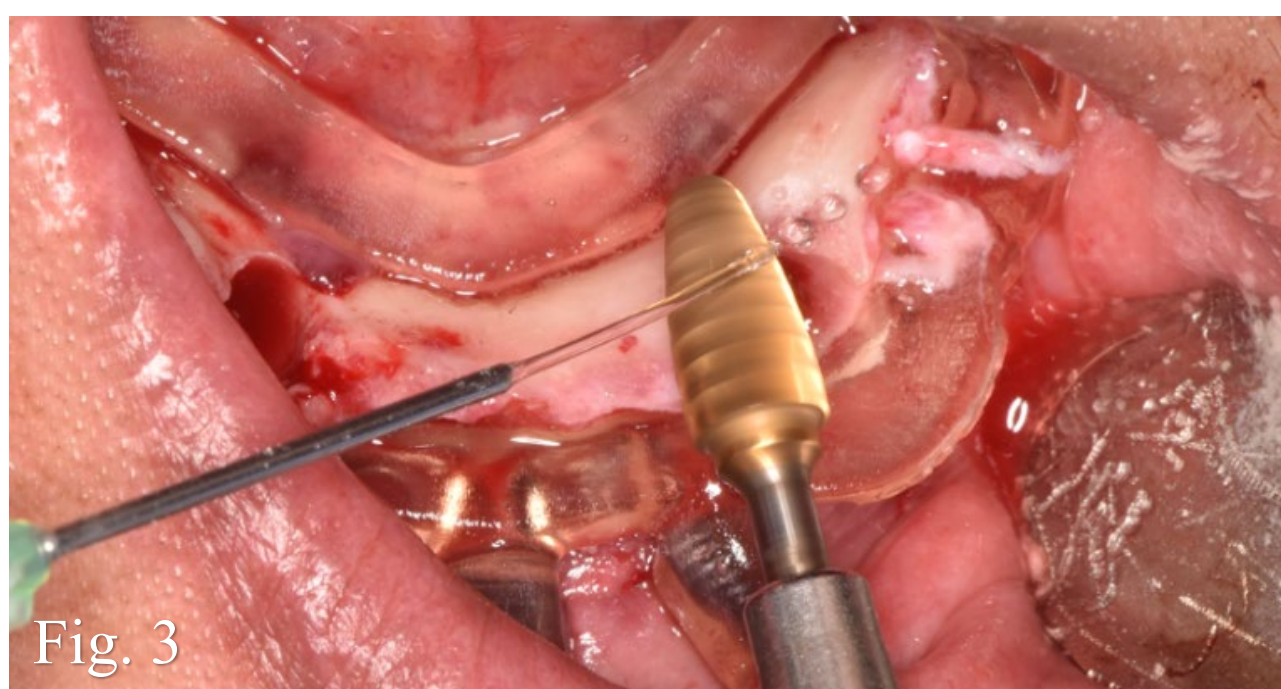
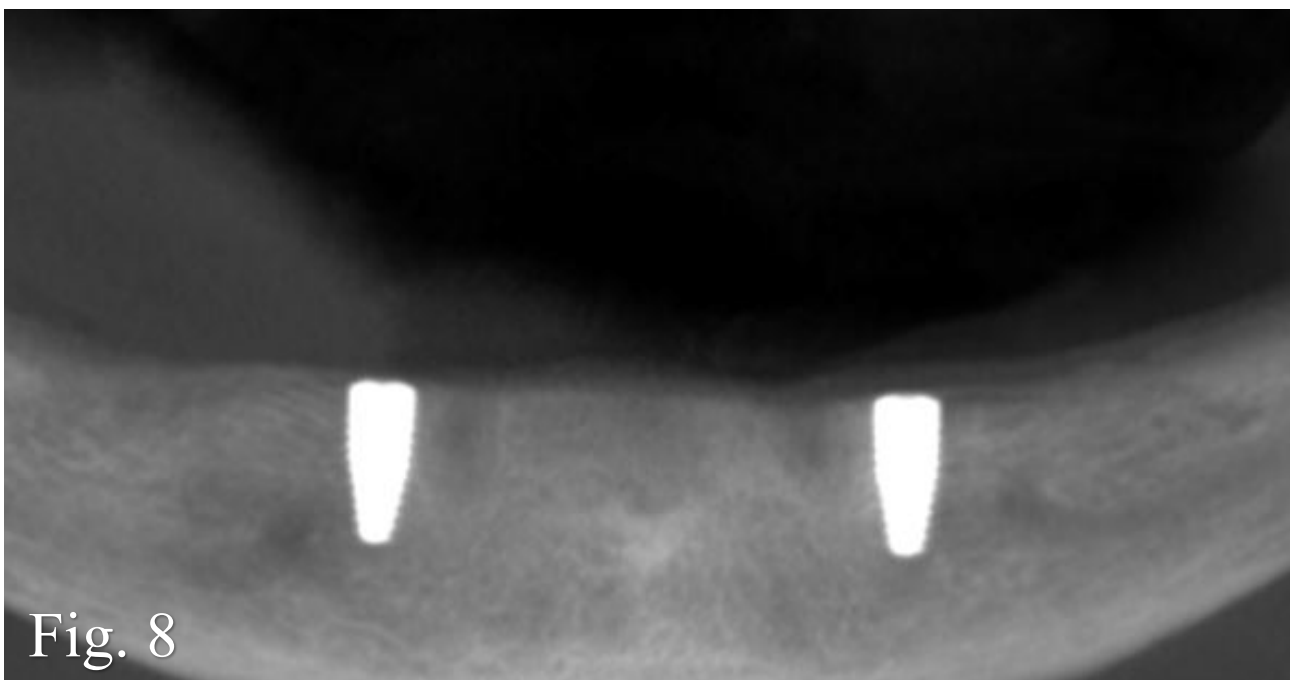
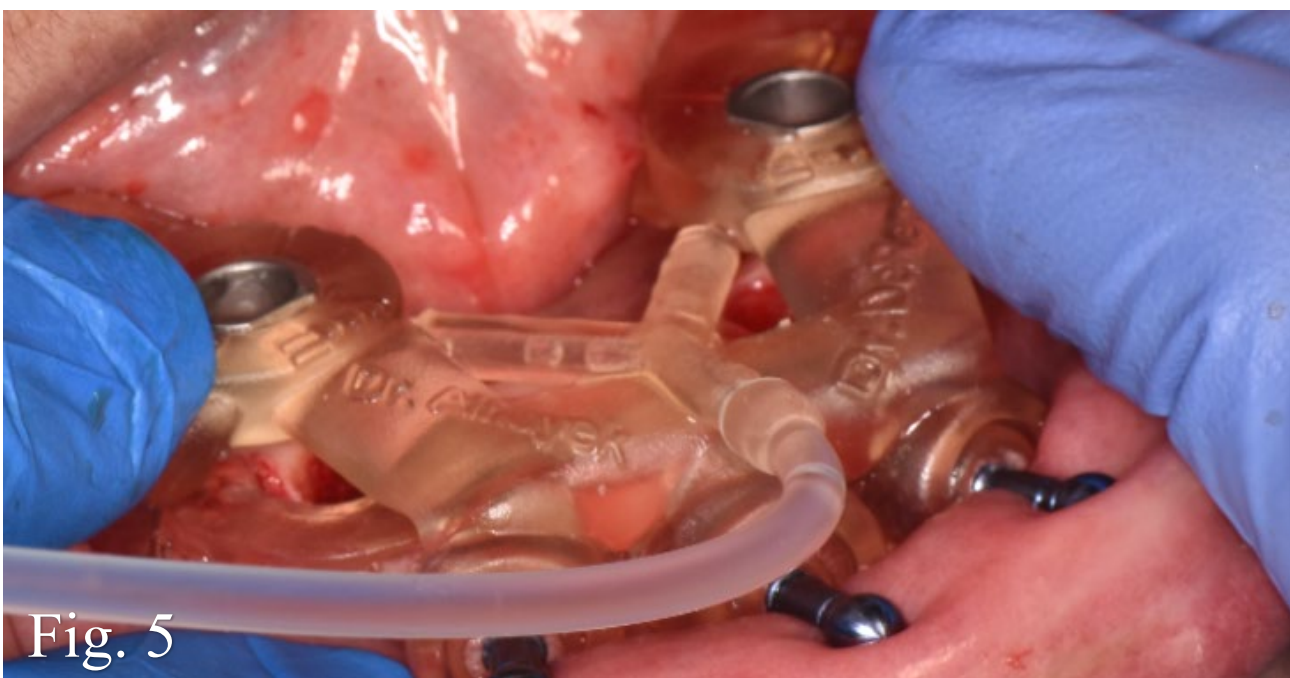
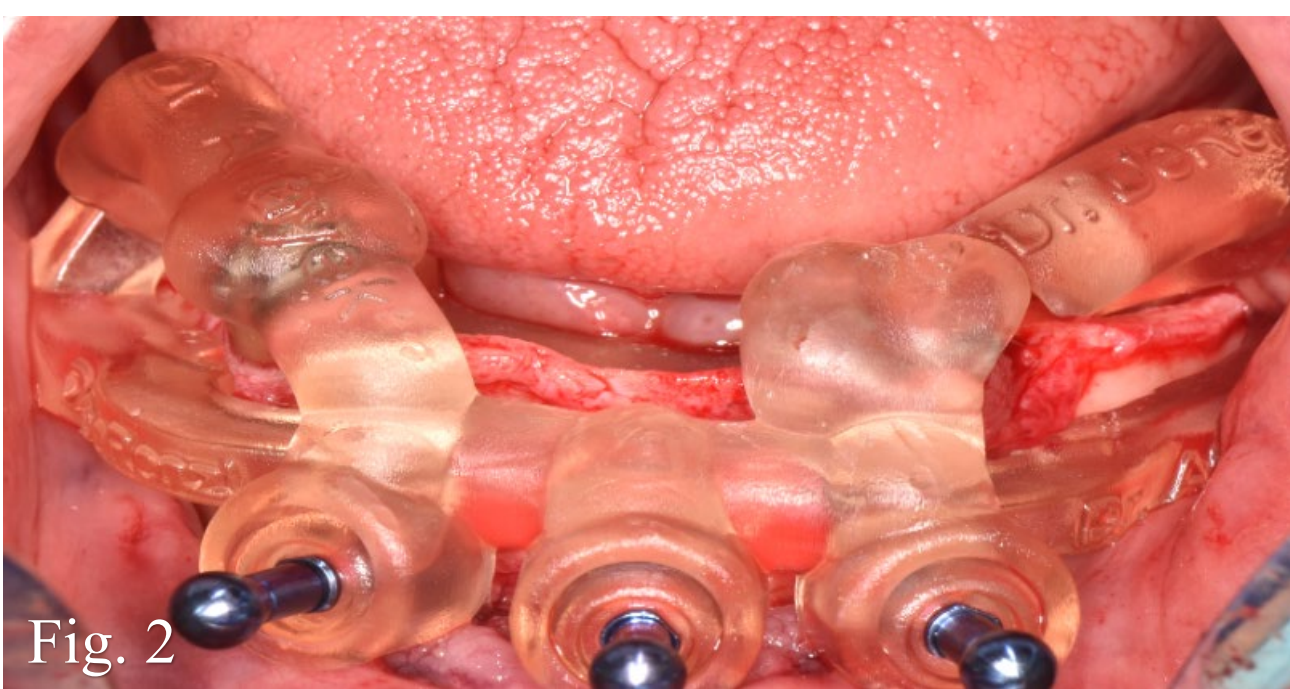
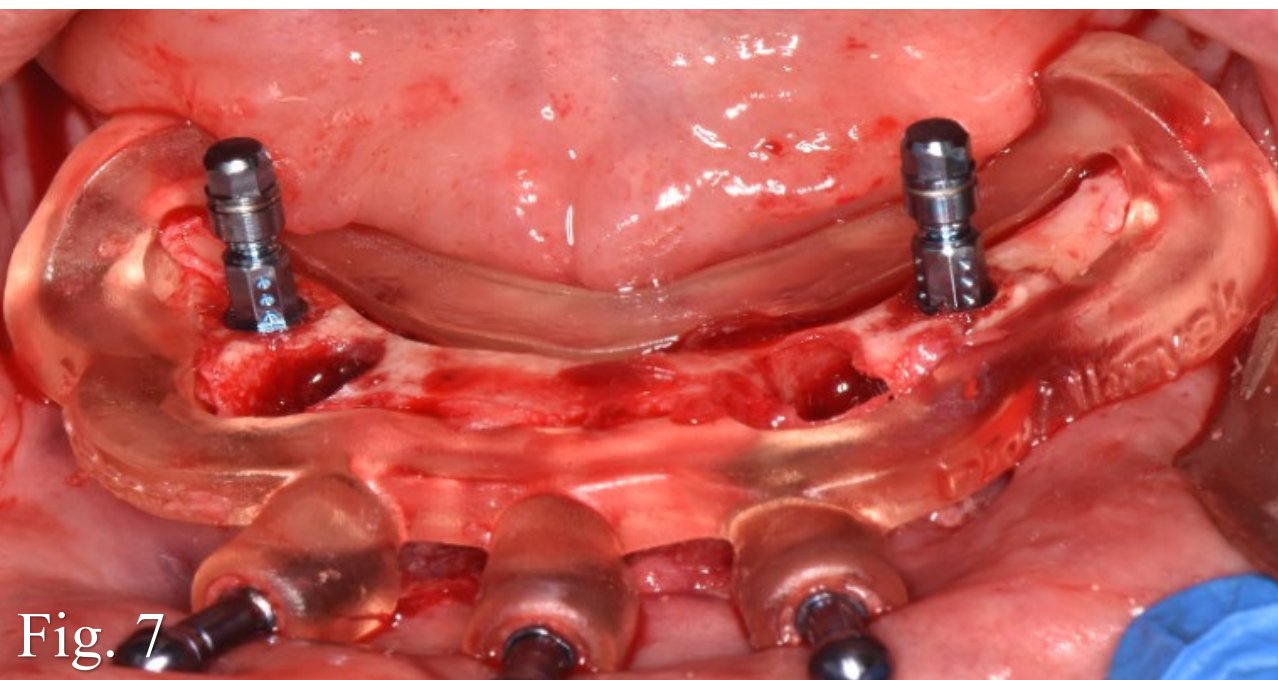
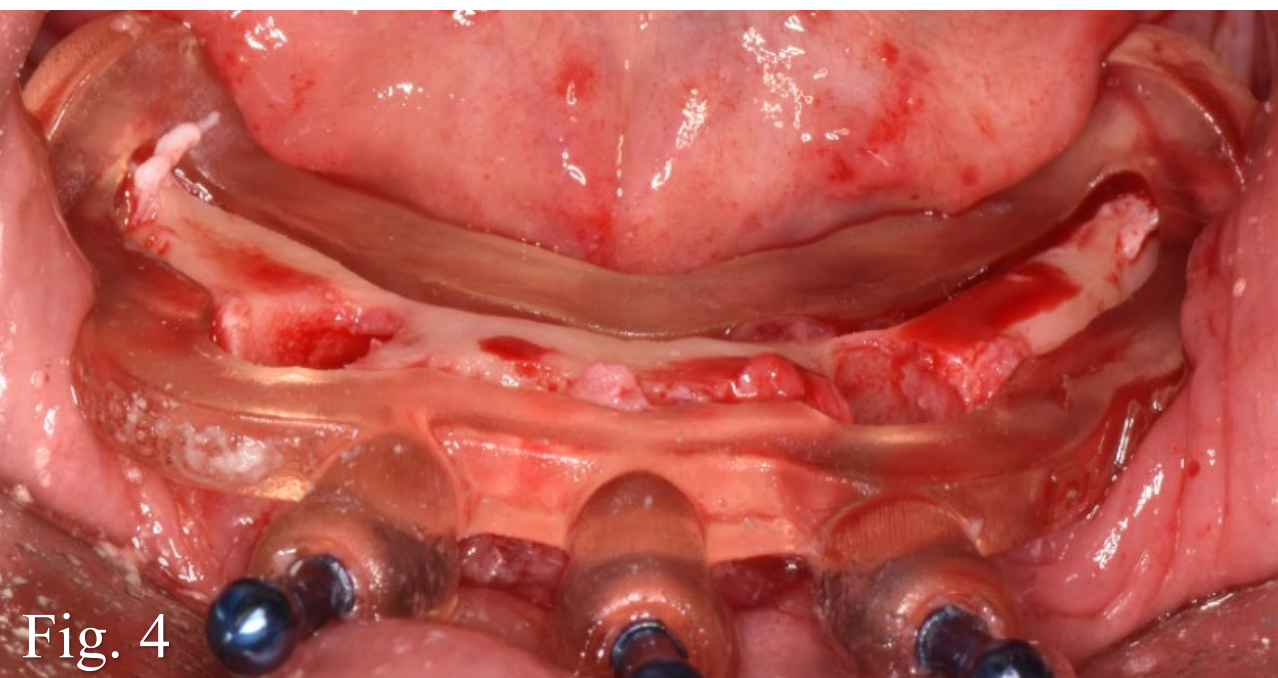
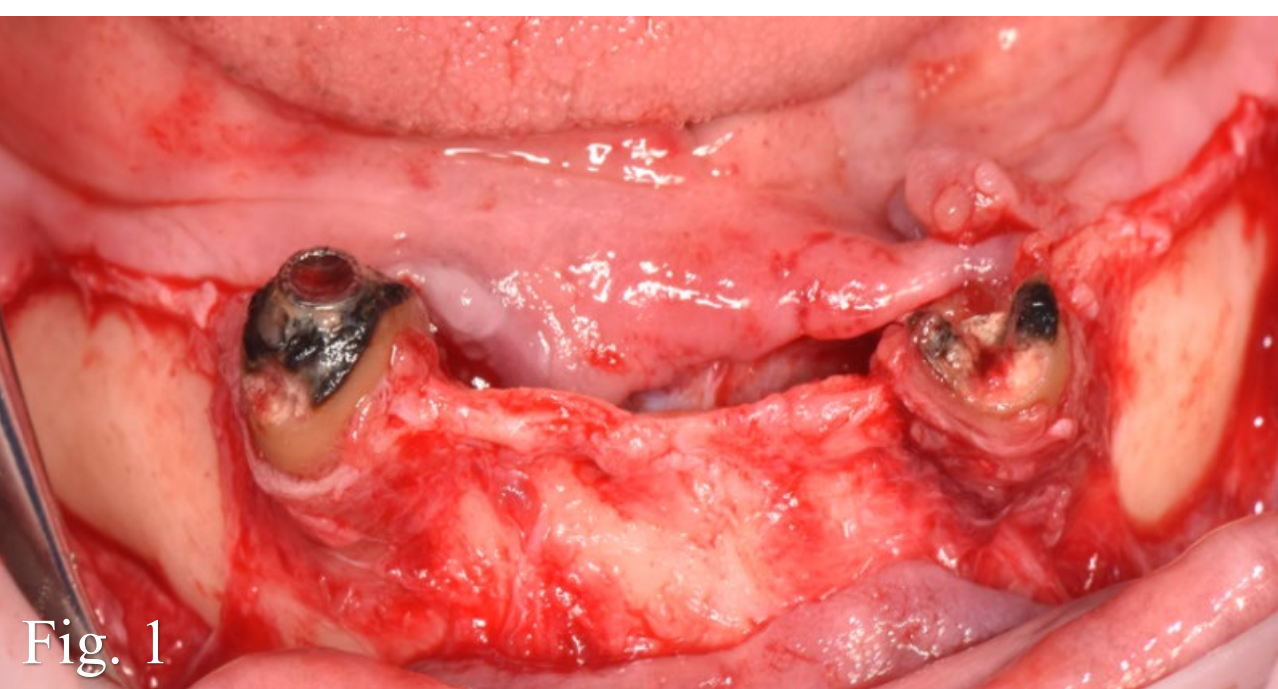
CASE 2:

A 43-year-old white male presented to the postgraduate prosthodontics clinic at Rutgers School of Dental Medicine, Newark, NJ, USA, in July 2025, few months after extracting maxillary left second molar and socket preservation seeking implant rehabilitation for the edentulous area.

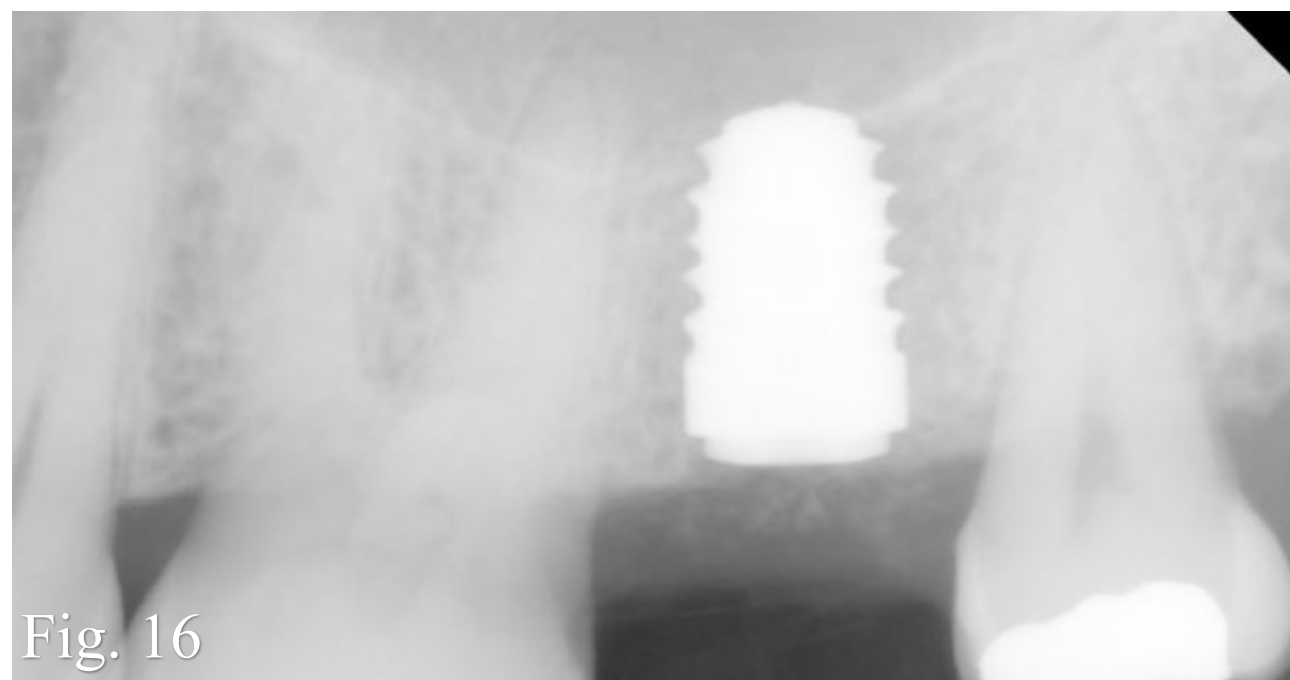
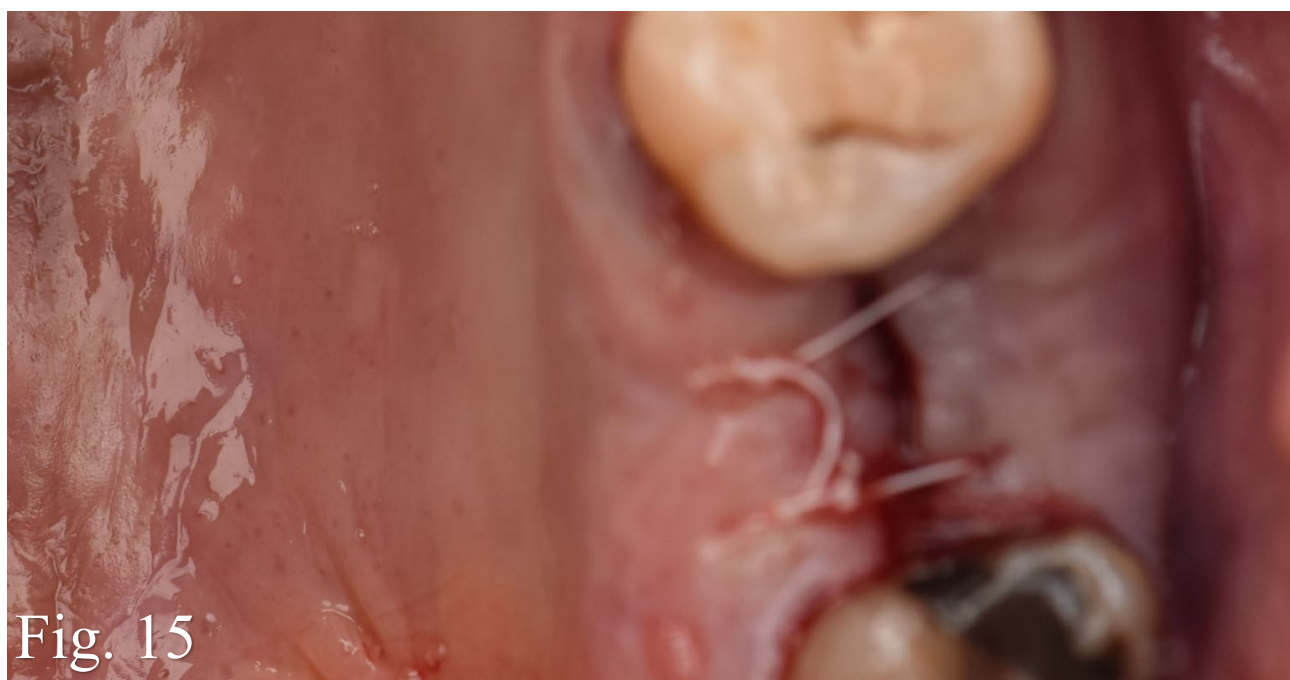
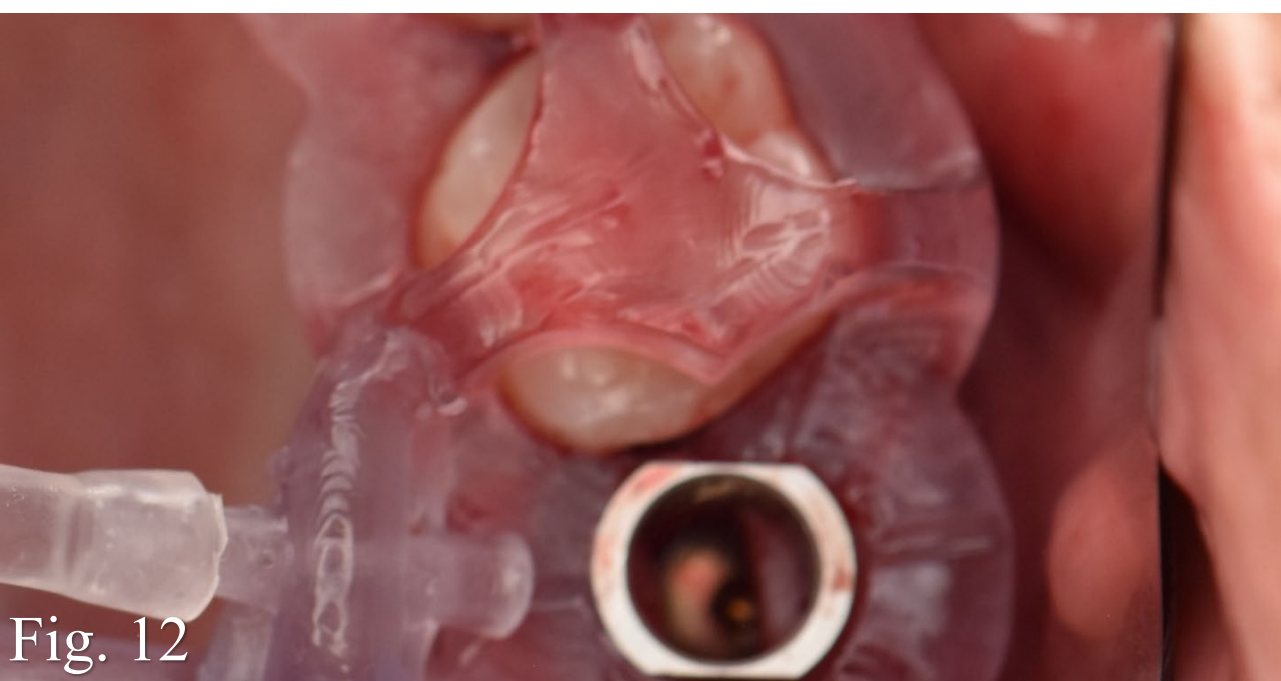
NOVEL EXTERNAL COOLING TECHNIQUE

1. Digital Planning: - Cone-beam CT and model scans were imported into coDiagnostiX™ software. - A virtual treatment plan was created to determine implant positions and surgical requirements.

2. Guide Design: - Case 1: Three stackable guides were digitally designed: (A) Alveolar bone reduction guide (bone-supported), (B) Tooth-supported fixation pin guide, (C) Final sCAIP surgical guide, interlocked with prior guides for stability. Case 2: A tooth-supported static surgical guide was designed.
3. External Cooling Integration: - Using CAD software (Meshmixer, Autodesk), novel irrigation ports were incorporated into each surgical guide. - This ensured continuous cooling during osteotomy preparation, reducing the risk of overheating.
4. Guide Fabrication: - Case 1: SLA 3D printer (Formlabs 3B+) - Case 2: MSLA 3D printing (Phrozen Sonic Mighty 8K Resin 3D Printer).



Case 1 SURGICAL PROCEDURES Fig 1. Full-thickness flap was raised. Fig 2. The bone-supported alveolar bone reduction bone guide mounted on the mandible after the incision and flap of the mucosa using the second tooth-supported fixation pins guide. Fig 3&4. Teeth were extracted and the alveolar ridge reduction accomplished according to virtual plan and reduction guide Fig 5&6. Third guide used to place dental implants according to pretreatment virtual plan. Fig 7. Installed implant with transfer piece. Fig 8. Post-treatment reconstructed Panoramic image with CBCT. Fig 9. Fabricated Three stackable guides.



Case 2 SURGICAL PROCEDURES Fig 10. Novel cooling system attached to both guide and handpiece. Fig 11. Full-thickness flap was raised and guided surgery performed under novel cooling. Fig 12. Close up of novel cooling system. Fig. 13. Closeup post osteotomy with abundant of saline irrigation to reduce overheating. Fig 14. Close up after 5.5x8mm TLC implant placement with healing cap. Fig 15. Two single simple interrupted sutures. Fig 16. Periapical Radiograph post implant placement.

CONCLUSION

1. This technique describes a contemporary digital workflow for virtual planning and fabrication of stackable guides with novel external cooling.
2. Through this case report, the novel external cooling system has successfully provided sufficient cooling during the sCAIP procedure.
3. Overall, this technique prevents overheating, which is beneficial for postoperative recovery by reducing soft and hard tissue trauma during implant site preparation.

REFERENCES



RUTGERS HEALTH
School of Dental Medicine