

3D Printing: A Revealing Pathway To An Unpredictable Maze

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INTRODUCTION

Traumatic injuries are common in permanent teeth before 19 years of age.¹ An incidental finding of large periapical lesions is common. A weeping canal secondary to an infected periapical cyst may require surgical intervention.

Untreated large periapical cyst can cause root resorption and pathological migration of tooth.² Buccal approach is the preferred choice for the visibility and convenience of surgery. Numerous cases present with lesions have intact cortical plates. Conventional technique would lead to more amount of bone removal.³ Hence, there is need for a technique which can allow preservation of the cortical plate.

CBCT plays an important role in endodontics.⁴ To complement CBCT, 3D Templates have been recently introduced for osteotomy and guided access preparation.

The present case highlights how CBCT and 3-D Printing were used in preserving the buccal cortical plate and allowed enough access while performing endodontic surgery.

CASE REPORT

A 22-year-old male patient had complaint of pain on biting hard food in the upper right anterior teeth since 1-2 weeks. He had history of trauma while playing 6-7 years ago.

Clinical examination revealed discolored old composite restoration with 11,12,21. Also, Angle's Class 3 malocclusion with anterior crossbite was noted. Tooth 11 was slightly tender on percussion. EPT showed no response with 11 & 12 and delayed for 13. IOPA revealed Class III restorations and large periapical radiolucency with 11,12,13. Based on the findings, final diagnosis of symptomatic apical periodontitis was formulated. As the patient had plans of migrating to another country, surgical approach was opted. To plan the surgery, small FOV CBCT was advised.

The CBCT revealed well-defined radiolucent lesion with an approximate size of 15.94 mm x 11.63 mm and intact cortical plate. Hence, 3D guided surgery was planned.

After administering local anaesthesia, routine endodontic treatment was initiated under rubber dam isolation and working length & BMP was done and calcium hydroxide dressings were placed. Obturation was done followed by a composite postendodontic restoration.

Schematic diagram of the template was prepared for communicating with template designer. The DICOM files from the CBCT images and soft tissue recordings through putty impression were uploaded into software and overlapped for the designing of the template. Then, template was fabricated.

At the start of the surgery, disinfection of tissue was done. The patient was anesthetized using long acting agent. A crevicular incision accompanied by two vertical releasing incisions was given. A full thickness flap was reflected and bone was exposed. Disinfection of template was done with 2% Chlorhexidine solution. The template was placed onto the teeth and bone cutting was done with long tapered fissure bur along the inner diameter of the template. The cut section of bone was preserved in saline and pathological tissue was sent for examination.

Apicectomy was done followed by root-end cavity preparation using endodontic ultrasonic tips and filling was done with the MTA.

After that PRF, bonegraft and tetracycline granules were placed in the defect. Then, preserved cortical plate was positioned back and the flap was sutured.

The patient was recalled after 7 days for suture removal. One-month, three-month and six-month follow ups showed satisfactory healing.

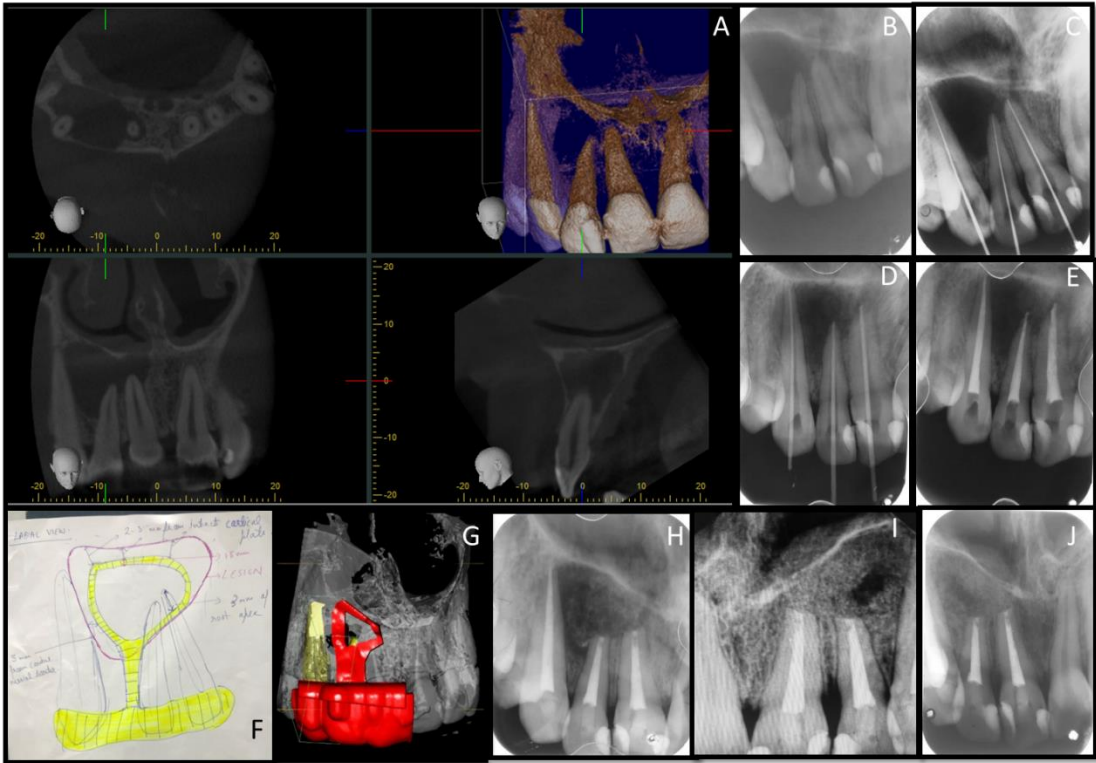


FIGURE 1 A - Pre-Operative CBCT, B - Pre-Operative, C - Working Length, D - Master Cone, E - Obturation, F – Schematic diagram of template, G – Template fabrication using CAD, H - Post-Operative, I -3 months follow up, J -6 months follow up

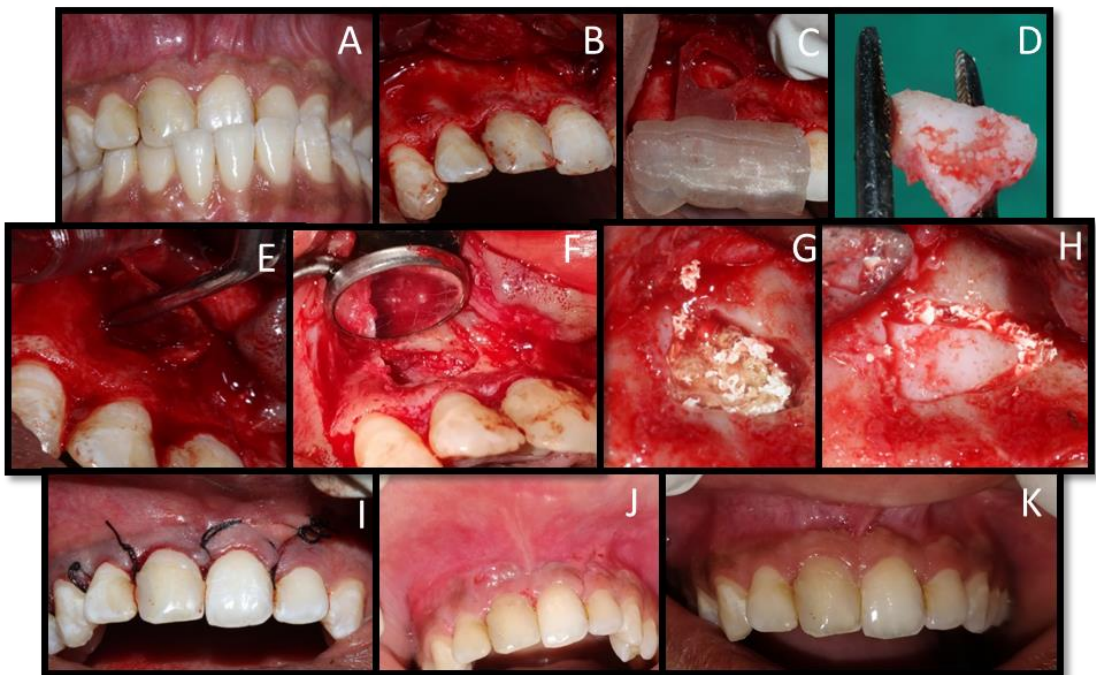


FIGURE 2 A - Pre-Operative, B - Full thickness flap, C - Placement of surgical template on the site, D - Removal of buccal plate, E - Removal of cystic lesion, F - Root end resection followed placement of MTA, G - Placement of PRF, Bone graft and Tetracycline granules, H - Placement of buccal plate, I - After suture placement, J - Suture removal after 1 week, K - Follow up after 6 months.

DISCUSSION

During endodontic surgery, an intraoperative removal of the buccal cortical plate may result in delayed healing.⁵ Hence, preservation of the buccal cortical plate is an important.⁵

With the aid of the CBCT and 3D printed template, minimal invasive surgery minimizes the tissue injury. This procedure enabled the surgeons to precisely remove the overlying bone and the root-end.^{6,7}

To increase the success rate, MTA is preferred as retrograde filling material due to highest healing rates and less leakage.⁸

To further enhance the healing, PRF was used. PRF is an autologous concentrate of platelets on fibrin meshwork that contains platelet-derived growth factor, transforming growth factor-beta, vascular endothelial growth factor, and epidermal growth factor. It also promotes healing and acts as better space filler.⁹

Amongst the various antibiotics used, tetracycline is favored due to better resorption, protein binding capability, diffusion into tissues and prolonged duration of action.¹⁰

The digitally designed template fabricated using CBCT, CAD and 3D printing technology worked in all aspects to facilitate the periapical surgery as anticipated. However, some discrepancy between planning and execution may be anticipated if we consider the accuracy of this technology. Further studies need to be carried out to confirm the accuracy of the 3D-printed template-aided periapical surgery procedure.⁶

CONCLUSION

Meticulous planning with technology can lead to successful treatment outcomes. 3-D printing can be used in innovative ways for preservation of tissues.

REFERENCES

1. Diangelis AJ et al. Guidelines for the management of traumatic dental injuries: 1. Fractures and luxations of permanent teeth. *Pediatr Dent* 2017 Sep 15;39(6):401-411.
2. Karthik R, Mohan N. Nonvital Tooth- A Clue for Diagnosis of Radicular Cyst- A Case Report and Review. *Int J Radiol Radiat Ther* 2017;2(4):92-93.
3. Von Arx T. Apical surgery: A review of current techniques and outcome. *Saudi Dent J*. 2010;23(1):9-15.

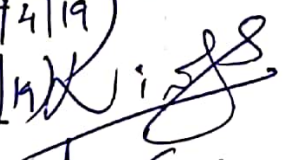


4. Meena N, Kowsky RD. Applications of cone beam computed tomography in endodontics: A review. *Dentistry*. 2014 Jan 1;4(7):1.
5. Hirsch V, Kohli MR, Kim S. Apicoectomy of maxillary anterior teeth through a piezoelectric bony-window osteotomy: two case reports introducing a new technique to preserve cortical bone. *Restor Dent Endod*. 2016;41(4):310-315.
6. Bhadra D, Shah NC, Arora A, Dedania MS. Deducing a surgical dilemma using a novel three dimensional printing technique. *J Conserv Dent*. 2018;21(5):582-585.
7. Ye S, Zhao S, Wang W, Jiang Q, Yang X. A novel method for periapical microsurgery with the aid of 3D technology: a case report. *BMC Oral Health*. 2018;18(1):85.
8. von Arx T, Peñarrocha M, Jensen S. Prognostic factors in apical surgery with root-end filling: A meta-analysis. *J Endod* 2010;36:957-73.
9. Mehta S, Watson JT. Platelet rich concentrate: Basic science and current clinical applications. *J Orthop Trauma* 2008;22:432-8.
10. Golub LM, Suomalainen, K and Sorsa, T. Host modulation with tetracyclines and their chemically modified analogues. *Curr Opin Dent* 1992;2:80-90.

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