Title:-A NOVEL APPROACH INCORPORATED IN GUIDED ENDODONTIC SURGERY -A CASE REPORT.

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Abstract-CBCT helps to address the limitation of interpreting pre-operative 2D radiograph representations by providing a 3D enhancement of the 2D radiograph. Endodontic therapy is often complicated and clinically demanding. Direct intra-oral localization of root apex based on the 3-dimensional information is extremely difficult and significant amount of bone removal is inevitable with free hand surgical procedure, so here widely accepted three dimensional technology that is 3D printing comes as a rescue. This aids in surgical planning, guided periapical surgeries with 3D templates /models and patient education. In this case, a 69 year old male patient was treated surgically by using 3D printed guide. A template that could be used to locate root-ends and lesion areas was virtually designed based on the data and was fabricated using a 3D printer by using SLA technology. With the guidance of the template, the overlying cortical bone and root-end were precisely removed by utilizing a trephine followed by surgical enucleation of the lesion. Therefore, the combination of 3D printing and CBCT has permitted us to perform difficult surgeries with comfort .The present case highlights the use of both CBCT and 3D

printing to preserve the cortical plate with maximum preservation and proper access to bony cavity while performing endodontic surgery.

INTRODUCTION

Endodontic surgery has been the treatment of choice for persistent apical periodontitis where conventional root canal treatment has failed [1] and for large periapical lesion. Conventional endodontic surgery involves exposure of the periapical pathology interpreted on the radiographs, curretage of the infected tissues, root end management and final closure of the site.

The disadvantages of 2-D imaging techniques are well known now in terms of identifying proximity to various anatomic structures.[2] However, major advancements in surgical technique as well as imaging modalities have left little to imagine for the specialists before performing an endodontic surgery. Cone beam computed tomography (CBCT) is one such advancement which has unleashed multiple avenues to deliver accurate diagnosis, uncover the hidden anatomic details and plan surgical treatment..[3]

Carrying the baton forward, 3 Dimensional-printing technology has provided new possibilities for surgical planning and execution. Preservation of buccal cortical plate using this technology is also reported.[4]

Endodontic surgeries have benefitted immensely from 3D printed models. However, the adaptation of the models to the underlying bone and stability of the guide have been a matter of concern. This case report describes a novel method for overcoming the above mentioned disadvantages and optimize the use of surgical guide to preserve the buccal cortical plate during endodontic surgery.

CASE REPORT

A 69 year old male patient reported to the department with a chief complaint of pain on chewing hard food in the upper front teeth region since 3-4 months. Patient gave history of root canal treatment done 15 years back for tooth no. 21 and 22. On Clinical examination, tooth no. 21 was found to be completely discolored and 22 had minor cervical discoloration. [Figure 1a] There was no associated swelling, sinus tract and they responded negative to percussion test. Intra-oral periapical radiograph (IOPA) revealed previously endodontically treated teeth 21 and 22. Extrusion of gutta percha (GP) beyond apex and incomplete obturation was evident with respect to 22 and 21 respectively. An ill defined radiolucency surrounded the roots of both the teeth were evident. Hence, a diagnosis of previously treated tooth with asymptomatic apical periodontitis (AAE 2013) was formulated for 21, 22 .

Non surgical endodontic retreatment was planned as the initial approach but the patient was educated regarding the possibility of need of surgical intervention in case of failure to retrieve the extruded gutta percha and due to time constraint.

Following administration of local anesthesia using lignocaine (Lignox 2% A, INDOCO RENEDIES LTD.) and rubber dam (Neelkanth HEALTHCARE (P) LTD) isolation, restorations were removed and GP removal was attempted using H files(Mani, Japan). A confirmatory radiograph revealed that the GP was removed from the canals of 21 and 22, however, the previously extruded GP was maintained at its position. After working length determination, biomechanical preparation was completed following circumferential filing technique using k files (Mani,Japan)along with copious irrigation with 3% sodium hypochlorite (Parikh trading Company, India) and normal saline (Otsuka Pharmaceutical India Private Limited). Calcium hydroxide, intracanal medicament (RC Cal ,PRIME DENTAL PRODUCTS PVT LTD.) was placed inside the canal for 2 weeks. Surgical approach was considered by taking patient’s consent and apicectomy was done at the same time to eliminate contamination.

A small volume CBCT scan (J morita) was taken to obtain a more comprehensive view of the periapical area. Dimension of the lesion, exact location of root apices and proximity of adjacent anatomical structures . Periapical radiolucency was evident irt 21,22 and Gutta percha extrusion was evident i.r.t 22. Since the buccal cortical plate was intact, it was decided to use surgical guide to preserve the same during the surgery. The DICOM files of the CBCT scan and an impression of the maxillary arch made with rubber base impression material (DMG, Honigum) was sent to the 3d printing lab The dimension of the guide was planned and communicated. The STL was then printed in Formlabs2 (Somerville,US) printer at the resolution of 0.05mm with Formlabs Clear resin (Photopolymer resin)It was further disinfected with 2% glutaraldehyde prior to surgical procedure. Just prior to surgery, canal were obturated with MTA(Angelus).

After disinfection of the skin, local anesthesia , Bupivacaine (BUPIWELL 0.5) was delivered. A crevicular with vertical releasing incision and full thickness mucoperiosteum flap was raised. The template was positioned on the teeth and was checked again for stability. Minor movement of the surgical guide and limited access for bone cutting was observed. To overcome these disadvantages, the cortical bone boundary was marked with Eosin pencil as guided by the template for accurate removal and its preservation. The template was then removed and the cortical bone cut was made under clear operating vision and straight access with the help of long shank straight fissure(S S white) surgical burs at slow speed. The block of the cortical bone was disengaged from the underlying bone using an curette. It was preserved for further use. Soft pathological tissues were easily removed with suitable sizes of sharp surgical bone curette and were sent for histopathological evaluation.

Root ends were resected upto 3mm. Since the canals were obturated using MTA, there was no need for root end cavity preparation. Before closure of the site, a 2nd generation platelet

substitute, a freshly prepared Platelet Rich Fibrin was packed inside the bony crypt preserved cortical plate was then placed in its position and gaps were filled in with a xenograft (G Graft granules).. The hydrated flap was repositioned and sutured using silk.

The patient was reviewed 7 days later for suture removal. The operating site was healing well, and no symptoms or postoperative discomforts were reported.After12 months of follow up, both the teeth were symptom free.

DISCUSSION

Persistent apical periodontitis is always treated with retreatment. Endodontic surgery is needed for the treatment of a large, cyst-like periapical lesion .Here, surgical approach was considered due to large size of lesion and persistent re infection along with extrusion of foreign material.

Endodontic microsurgery (EMS) requires a targeted osteotomy and root end resection based upon anatomic landmarks and preoperative CBCT measurements. Osteotomy can deviate from the ideal as a result of human error in clinical scenarios where proper orientation, angulations and depth of preparation are challenging. Difficulty is encountered while treating posterior region or in cases where anatomic structures approximate the root end, potentially leading to extraction.[6]

Here, the guide template acted as a soft tissue retractor and avoid iatrogenic soft tissue damage. Endodontic microsurgery using the guide template allows precise localization of root apex, minimally invasive osteotomy, decreased surgical time, favorable post-operative healing and improved prognosis regardless of clinician's experience..[7]In this case, the SLA technology (stereolithiography) 3D-printed model of different sections of the pathology was fabricated which gave us the idea about precise dimensions and position of lesion. This technology uses a scanning

laser to build parts one layer at a time, in a vat of light-cured photopolymer resin. Each layer is traced-out by the laser on the surface of the liquid resin, at which point a 'build platform' descends, and another layer of resin is wiped over the surface, and the process repeated.[8] This gives very smooth surface finish, detailed reproduction and gives snap fits.

Here this minimal invasive surgical procedure causes less damage to osseous tissues which results in less haemorrhage during surgery, less postoperative complications, shorter healing time and better prognosis and cortical plate was thus preserved.[2]

Replacing the cortical bone plate indirectly allows us to use an autogenous bone graft. These grafts are superior to any other grafts as they have osteogenic, osteoinductive and osteoconductive property.

Marking the required bone cut boundary with pencil allowed us to remove the template during bone cutting. This in turn allowed better visualization of the site, accurate orientation of the bur angle, decreased contact time of the resin based stents with the bone and elimination of template stability issue.

PRF was used as it accelerates the healing process due to release of multiple growth factors and serves as an ideal scaffold. It also stabilizes the overlying cortical plate which was replaced. This prevents the collapse of the preserved cortical plate.[9]

CONCLUSION

With the increased use of 3 D printing technology in surgical endodontics, it is required to optimize its use to overcome the associated disadvantages. The above mentioned technique

allows us to harness the advantages of this technology while making the procedure more predictable and easy.

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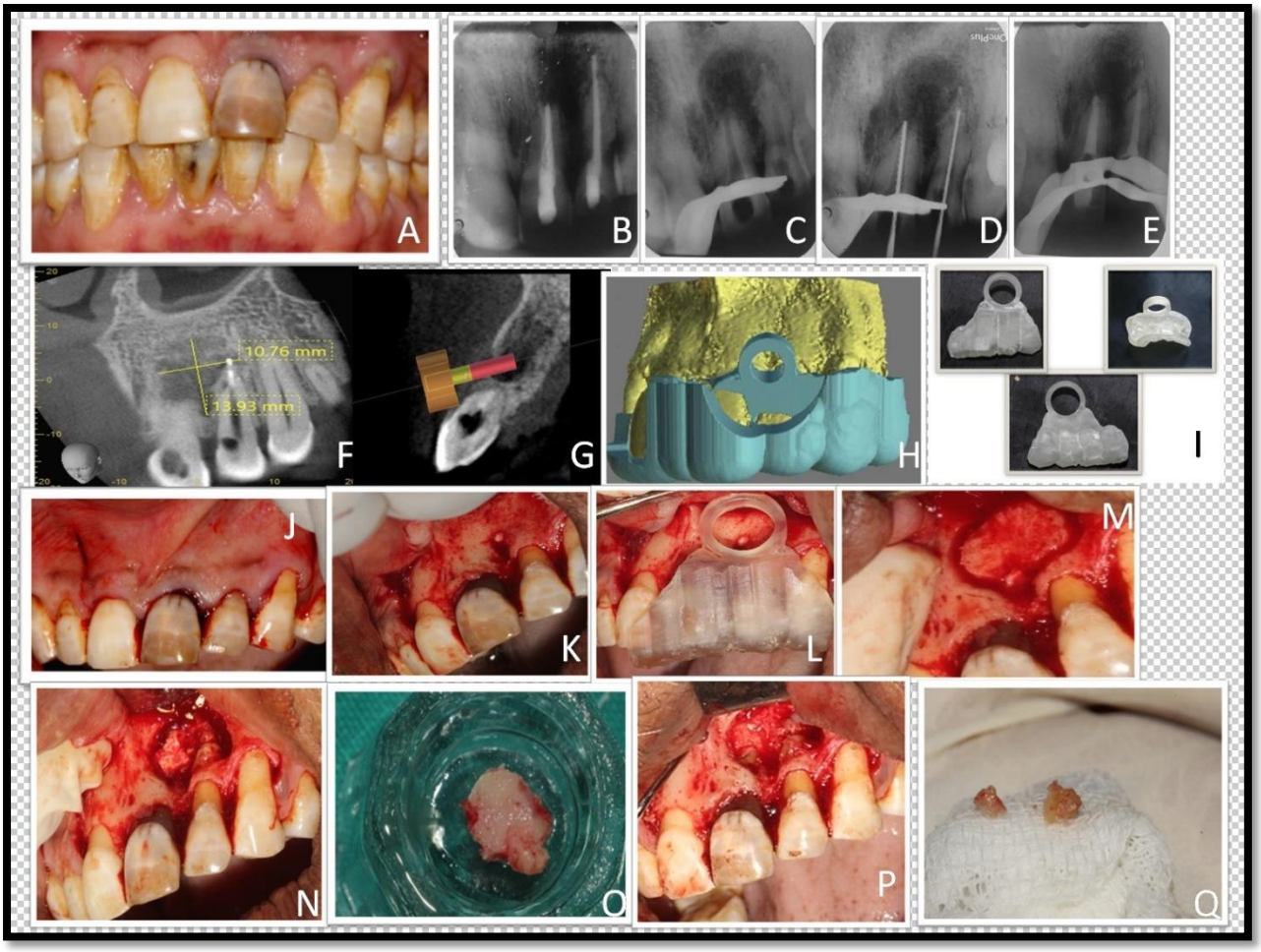

FIGURE 1:- A) Pre-Operative photograph, B) Pre-Operative Radiograph, C) After guttapercha removal, D) Working Length Determination, E) MTA obturation, F) Marking of Lesion in CBCT, G) Designing for 3D model fabrication, H) CAD designing, I) 3D printed model with surgical guide, J) Crevicular with vertical releasing incision, K) Full thickness mucoperiosteal flap raised, L) Placement of 3D guided template, M) Marking of Buccal Cortical Plate, N) Infected tissue removal, O) Preservation of buccal cortical plate , P)Curettage, Q) Resected root ends.

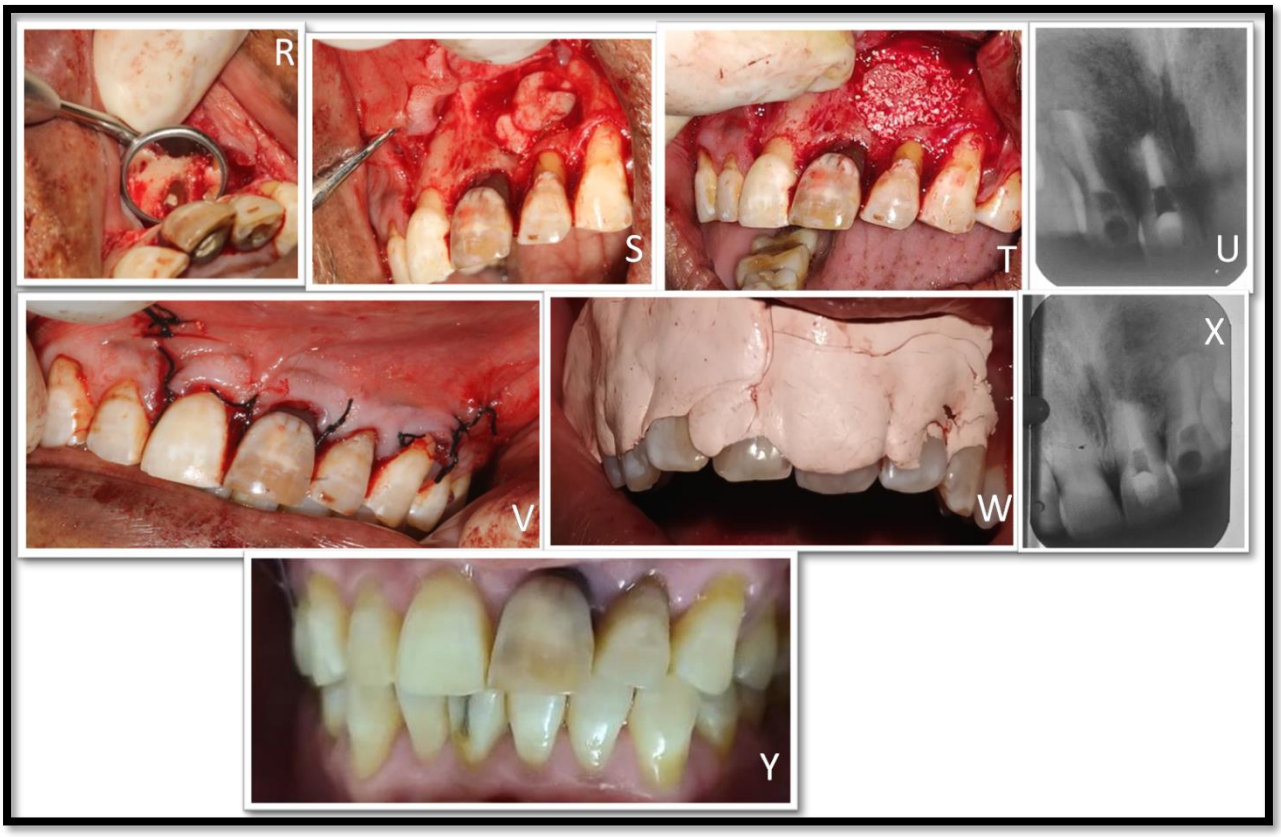

FIGURE 2:- R) Exposure of root end , S) PRF placement, T) Cortical bone and bone graft placed, U) Post operative radiograph, V) Single interrupted sutures taken, W) Periopack placed, X) 3months follow up radiograph, Y) 12 months follow up.

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