DEDUCING A SURGICAL DILEMMA USING A NOVEL 3D PRINTING TECHNIQUE - A CASE REPORT

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INTRODUCTION

The principle objective of endodontic retreatment is to treat apical periodontitis caused by reinfection of the root canal system. However, apical periodontitis can still persist even after secondary root canal treatment. The reason for the failure can be attributed to various factors like intricate anatomy, missed canals, iatrogenic errors etc. Even the use of sophisticated armamentarium doesn't nullify the chances of failure, such cases may then require surgical intervention.[1,2]

CBCT prior to endodontic surgery may allow the endodontist to identify accessory anatomy, untreated root canals, visualise the true extent of a periradicular lesion, and prevent damage to vital anatomical structures. [3,4]

3D scans using CT imaging have not only been applied to the visualization of an object but also to the generation of a physical model. 3D printing technology for making a physical model, also better known as, Rapid prototyping has provided new possibilities for diagnosis, surgical planning, prosthesis design, and student education in dentistry. In endodontic treatment, a physical tooth model fabricated by 3D printing has been used for patient education and also in various cases such as the diagnosis of atypical root morphology, guided access preparation, determination and locations of root resorption, and surgical planning.[5] Zehnder et al. also used CBCT and intra-oral optical scans to produce 3D printed templates to gain guided access to root canals.[6]

This case describes a surgical endodontic therapy, which takes advantage of 3D technology that is

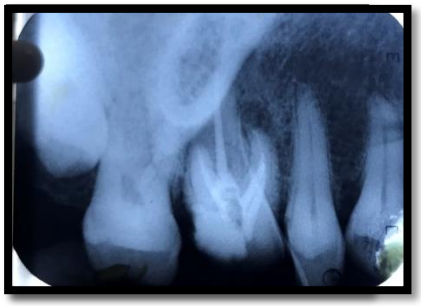
becoming increasingly accessible in dentistry.

CASE REPORT

A 45 year old healthy male patient reported with a chief complaint of pus discharge in the upper right back tooth region since 1 year. Past dental history revealed a previously done endodontic treatment with 16. Clinical examination showed a draining sinus tract in close proximity of 16. GP tracing on radiograph showed area near the distobuccal root of 16 to be the cause of the infection with satisfactorily filled root. Tenderness on percussion was absent. Hence the diagnosis formulated was previously treated 16 with chronic apical abcess. Non surgical re-endodontic therapy with 16 was chosen as the first line of treatment. A multivisit re-endodontic therapy with intermediate calcium hydroxide(RC Cal) dressing for 1 month was done and dressing was changed after every 7 days. After the sinus tract healed and the canals were dry, obturation with gutta percha(Diadent) and resin sealer(AH Plus) with lateral compaction followed by a composite post endodontic restoration with extendingfrom themesial border of 16 to the mesial border of 18.And as the endodontic treatment had failed twice, a surgical approach was planned.However the extent of the lesion and its relation was in close approximation with the maxillary sinus lining and the patient was reluctant for the surgery. Hence 3D printed models of the concerned region were fabricated for patient education as well asto determine the exact location,extent and relation of the pathology.It exposed the presence of a pathology thatwas distinct from the maxillary sinus.The pathology was then enucleated by reflecting a full thickness envelop flap and the mesiobuccal and distobuccal roots were resected 2 mm each followed my retrofilling with MTA. The histopathological analysis confirmed the diagnosis of a radicular cyst. Patient was recalled after 1 week for suture removal and follow up check up that showed a healed sinus tract. 1,2 and 3 months follow up showed no recurrence of any signs or symptoms hence a full coverage crown was fabricated and cemented with 16.

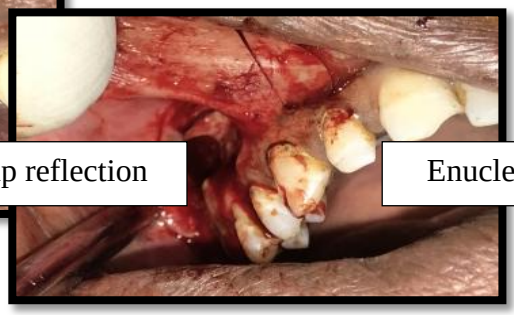
Case of the Month – February 2018

Sinus Tracing



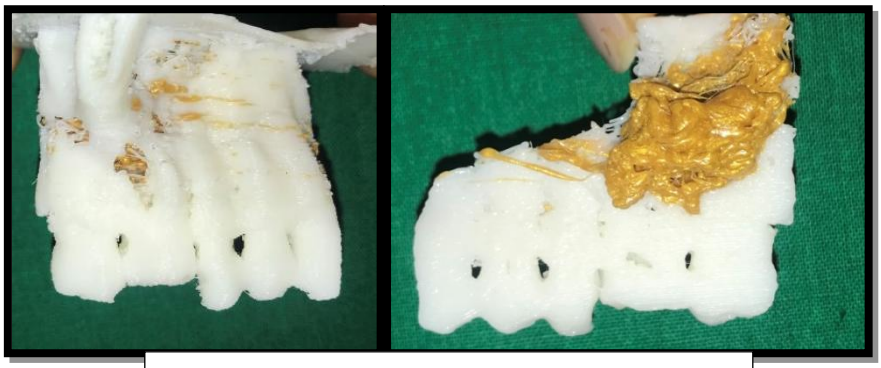
Pre-operative Radiograph and CBCT image of the tooth

Full thickness flap reflection

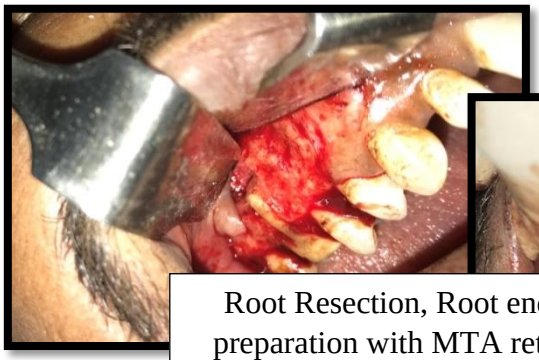


Enucleation of cyst

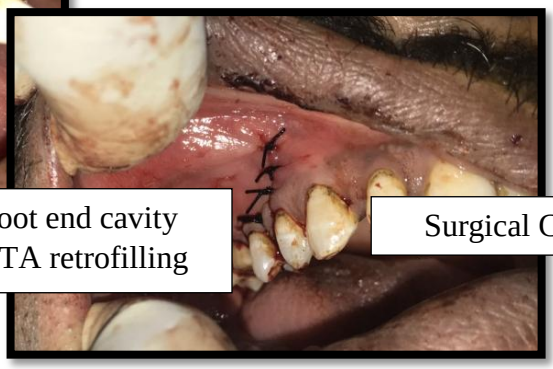
Comparison of cyst with 3D printed



3D printed full model and Cross Section



Root Resection, Root end cavity preparation with MTA retrofilling



Surgical Closure

Clinical photograph after prosthesis

Post-operative

DISCUSSION

Persistent apical periodontitis is preferably treated by root canal retreatment.[1] However, post-

treatment failure can still occur when treatment has been performed to a good standard.[7] The infected site(s) may not be accessible by conventional therapy, and therefore may require surgical intervention.[7] This case presented a surgical dilemma that made it challenging to operate and it became mandatory to clear the understanding of the pathology present that wasn't even clear on a CBCT scan. Because CBCT showed a radiolucency above the roots of teeth approximating the maxillary sinus very closely. Here is when the FDM (Fused Deposition modelling technology) 3D printed models of different sections and a 3D printed model of the pathology were fabricated that alone gave an exact idea about the dimensions and position of the lesion. After enucleation even the size of the excised lesion was almost similar to that of the 3D printed model of the lesion.[8] This also approves of the accuracy of the 3D printing technology as they have shown to have a discrepancy less than 0.1mm.[8] 3D printing can be used with various manufacturing techniques like FDM, Stereolithography, LOM, SLS etc. FDM and Stereolithography are mostly used in dentistry because of easy of manufacturing and good accuracy.[8] As the models were fabricated for education and diagnosis purpose FDM technology was used. In the dental surgery, intra-oral and CBCT scanners are becoming more mainstream, and dental professionals are becoming well acquainted and adapt at working with large volumes of digital data.[8] Hence developments and access to scanner technology and CAD software have made this technology easier to use. [9]

2mm of root resection at 90º was done in order to preserve the dentin as well as to minimize seepage due to exposure to dentinal tubules in the apical third and ultrasonics were used to prepare cleaner root end preparation.[10] MTA was used for retrofilling because of its biocompatibility and chemical bonding with the tooth and also bioactive potential. [11] Hence a 3 month follow up after the use of a combination of novel 3D printing technology and endodontic principles gave very satisfactory and promising results.

CONCLUSION

Use of 3D printing with the help of CBCT scans provides a physical in and out information regarding all kinds of pathology thus making complex surgical treatments more accurate and their results more predictable.

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