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Use of CBCT in surgical decision making for the management of large periapical lesion: A case report

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Abstract
Surgical management of periapical pathology poses a dilemma when the radiolucency in the intraoral periapical radiograph extends to root tip of the adjacent vital tooth. But since it is two-dimensional representation of the object, most of the times it gives a false impression of the involvement of a vital tooth. Since the advent of the advanced diagnostic aids like CBCT the clinician can actually decide predictably whether to involve the adjacent vital tooth for the surgical planning by compromising the vitality or to preserve the vitality of the tooth after carefully evaluating the apical portion of the involved tooth. The present case report is one such conservative management of a case without compromising the vitality of the adjacent tooth by using the CBCT.

Keywords: apical root resection, CBCT, enucleation, maxillary central incisor, periapical lesion, platelet‐rich fibrin

Introduction
The primary goal of apical surgery is to surgically treat a tooth that primarily has an endodontic lesion that cannot be resolved by conventional endodontic treatment. It is therefore of clinical relevance to carry out a thorough clinical and radiographic examination of the tooth before apical surgery including adjacent teeth, in order to decide whether surgical or non-surgical endodontics should be considered. The use of a surgical microscope is strongly advocated in apical surgery since it allows inspection of the surgical field at high magnification with excellent and focused illumination, detection of microstructures (additional canals, isthmus) and root integrity (cracks, fractures, perforations), distinction between bone and root, and identification of adjacent important anatomical structures [1].

Apical surgery has greatly benefited from continuing development and introduction of new diagnostic tools, surgical instruments and materials, making this method of tooth maintenance more predictable [2]. Success rates approaching 90% or above has been documented in several clinical studies [3]. Although nonsurgical retreatment generally is believed to be the preferred first approach in the management of persistent apical periodontitis. Periapical surgery is indicated when nonsurgical retreatment is impractical or unlikely to improve on the previous result [4].

Accurate diagnosis and treatment planning are the backbone of any medical therapy; for this reason, cone beam computed tomography (CBCT) was introduced and has been widely used. CBCT technology provides a three-dimensional image viewing, enabling exact location and extent of lesions or any anatomical region. Use of these technologies helps the clinician to exactly determine the extension of the pathology there by limiting the treatment plan to only the involved structures. This will definitely save the clinicians as well as patients time also maintains the vitality off the non involved tooth. The objective of this paper is to report one such case where we were able to preserve the vitality of the lateral incisor because of the use of CBCT while treating the pathology associated with the Maxillary central incisor.

Case report
A 26-year-old male patient was referred to the Department of Conservative Dentistry and Endodontics with Chief complaints of pain, discoloration& pus discharge from maxillary front teeth since 15 days. Patient was apparently alright15 days back, when he experienced pain& pus discharge from the upper front teeth region of jaw. He presented with a history of trauma (hit by a cricket ball) about a year back. On clinical examination tooth 21 showed discoloration along with draining sinus & Pus discharge [Figure 1a]. On further investigation, a negative response to pulp vitality testing was noted with help of electric pulp test and cold test. Whereas the 22 showed a vital response to both the electrical and thermal testing. On radiographic examination radiolucency involving enamel, dentine, pulp with periapical radiolucency was noted with 21 which were extending almost to the root of the 22[Figure 1c]. A final diagnosis of pulp necrosis with chronic periapical abscess with 21 was determined. Root canal treatment of 21 was planned as an immediate treatment followed by the apicoectomy and retrofilling.

For further investigation a limited FOV CBCT was advised to

determine the exact extension of the lesion to rule out the involvement of root tip of the lateral incisor which guided us not to involve the lateral incisor in the treatment plan [Figure 1b]. It was evident in the CBCT that there was a disto-lingual curvature of the root tip of the lateral incisor which was covered with the healthy bone.

After determining the working length of the left maxillary central incisor, Cleaning and shaping was then performed using step-back technique by hand K file and 3% sodium hypochlorite (Prime dental products) and 17% EDTA (Prime dental products) were used alternatively as irrigating solution with 23 G needle. Ca $(OH)_2$ (RC Cal-Prime dental products) medicament was placed in the canal for a week and it was changed again to thoroughly disinfect the canal. Tooth was obturated using AH plus sealer (AH Plus, Dentsply DeTrey, Konstanz, Germany) and Guttapercha cones (Diadent, Almere, The Netherlands) by lateral condensation method. Post endodontic restoration was placed using composite resin [Figure 1d].

Micro surgery was planned in association with the department of oral and maxillofacial surgery for the surgical curettage of periapical area in relation to the 21. A full thickness mucoperiosteal flap was raised extending from the mesial papilla of the 11 to that of the distal papilla of 23. Bony window was seen in relation to 21 in the apical 1/3rd [Figure 1e]. The bony window was extended till the healthy bone with a slow speed fissure cutting bur using water coolant. After which the curettage was carried out under the magnification 1.5 X using Labomed operative microscope. Care was taken not to damage the apical portion of the 22. Apical resection of 21 was made to the amount just required for preparing the retrograde cavity [Figure 1f & 1g]. MTA (Mineral trioxide aggregate) was used as the retrograde filling material after which the bony cavity was filled with the autologous PRF and alloplastic bone graft [Figure 2a & 2b].Suturing was done with triple-zero silk to reposition the flap [Figure 2c]. Postoperative Radiograph was taken [Figure 2d]. Antibiotics, NSAID and an oral rinse solution were prescribed, and the sutures were removed on the seventh postoperative day. Recall visit showed positive vitality finding with the left maxillary lateral incisor. 6 months follow up showed complete healing of the sinus tract and significant bone formation [Figure 2e].

After 6 months of successful follow-up, teeth were prepared with a shoulder margins in a standardized manner, and all margins were placed at the equigingival level. Impressions were made with a elastomeric impression material (Impregum; 3M ESPE) using a custom tray. After the impression procedure, temporary resin crowns were immediately adapted and cemented on the prepared teeth with zinc oxide-eugenol-based temporary cement (Temp Bond; Kerr Corp., Orange, CA, USA). Zirconia based all-ceramic crowns (IPS e.max ZirCAD MT, Ivoclar Vivadent) were designed and fabricated with the use of computer-aided design/computer-aided manufacturing technique. All-ceramic crowns of the maxillary central incisor was cemented using resin composite cement (Panavia F, Kuraray Medical Inc., Tokyo, Japan) according to the manufacturer's instructions. The patient's esthetic and functional expectations were achieved after the prosthetic rehabilitation [Figure 2f].

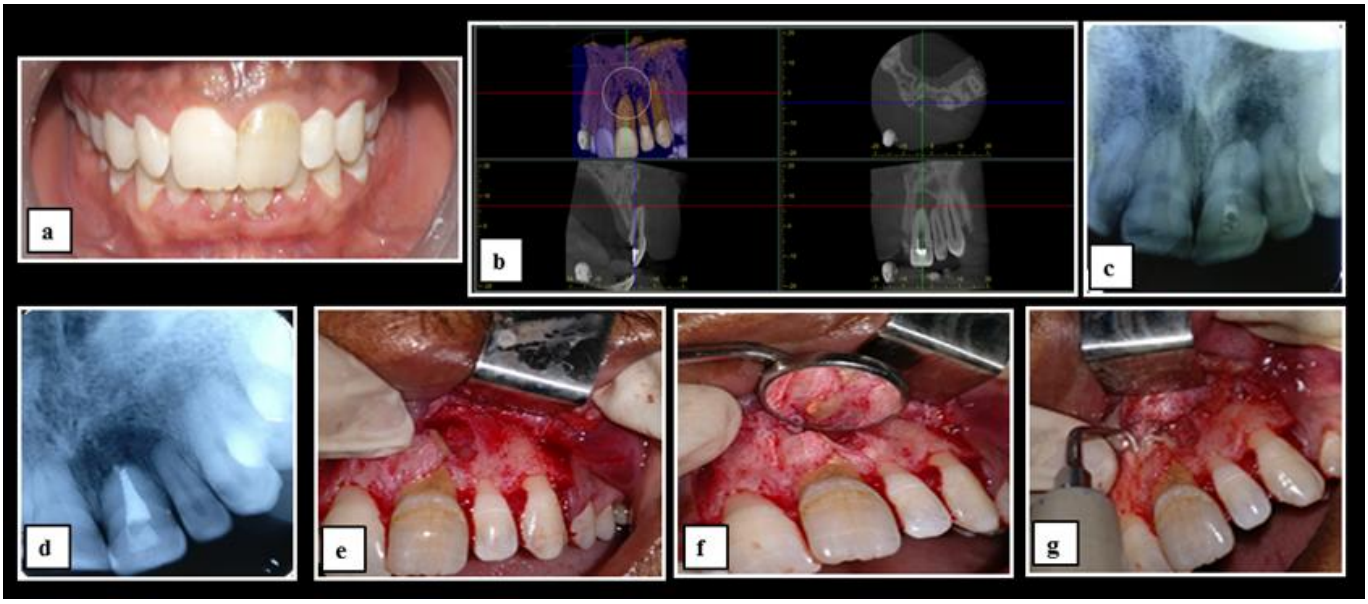

Fig 1: (a) Pre-operative clinical photograph, (b) Cone beam computed tomography (CBCT) evaluation, (c) Pre- operative Periapical radiograph of the left maxillary central incisor (#21) with apical radiolucency, (d) post-obturation radiograph, (e) Flap reflection and bony window prepared, (f) Root end resection, (g) Root end preparation in 21 followed by enucleation.

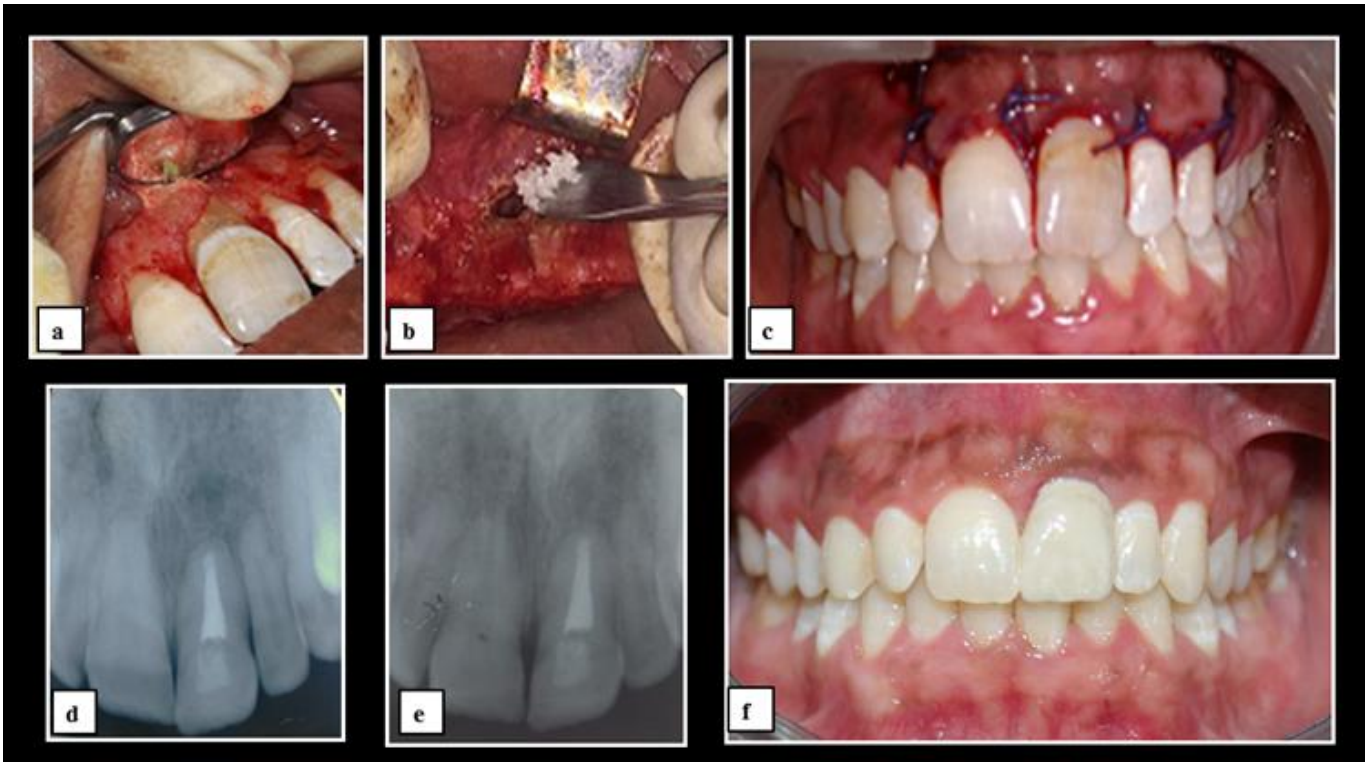

Fig 2: (a) root end filling, (b) autologous PRF with alloplastic bone graft placed, c) Interrupted sutures, (d)Postoperative Radiograph immediately after placement of MTA root end filling and the bone graft, (e) six months follow-up radiograph showing periapical healing, (f) Clinical photograph after All ceramic crown cementation

Discussion

Microsurgical principles in apical surgery include production of a small osteotomy for access to the root end, resection of the root end perpendicular to the long axis of the root, inspection of the resected root face for microstructures, and preparation of a root-end microcavity. These surgical steps are important to minimize surgical trauma and to create optimal conditions for the subsequent root-end filling. Technical requirements for the performance of apical microsurgery include the use of magnification/illumination and microsurgical instruments [5].

In the present case, endodontic treatment was carried out in multiple visits with interim calcium hydroxide dressings. The use of root canal dressings between sessions in root canal treatment of teeth with chronic periapical lesions is important for reducing levels of bacteria better than that obtained with mechanical preparation, particularly by penetration of areas that are unreachable by instruments or irrigation solutions, such as dentinal tubules and ramifications. Calcium hydroxide has also shown clinical efficiency in reducing exudate due to its hygroscopic properties. Studies have shown that at least 2 weeks are necessary for calcium hydroxide bactericidal activity [6].

The present case was considered for the microsurgical procedure as the root tip of the lateral incisor was very close to the apical pathology as it was confirmed with the help of limited FOV CBCT. Absolute precision was required when operating in the surgical field to differentiate between the bone and the root tip especially when we need to maintain the vitality of the adjacent teeth. Use of microsurgical instruments along with the magnification and illumination we were able to precisely locate the lesion extension and curettage the area without hampering the root tip of the lateral incisor.

Apicoectomy has been recommended as a treatment procedure after endodontic treatment. However, apicoectomy, as the first choice of treatment for non-vital incisors with large periapical defects has occasionally been documented. In our patient, mineral trioxide aggregate (MTA) was used to obtain the apical seal. It has been known for its outstanding tissue compatibility and has been found to stimulate periapical healing and the production of cementum and bone [7]. According to Jansson *et al*., the survival rates of endodontic surgery was found to be 77% in single rooted teeth over a 10‑year period [8]. In the present case, absence of tooth mobility together with enough root length and good crown reinforced the decision to preserve the tooth and to manage the case surgically.

Bone formation following periapical surgery can be accelerated by placing bone graft with PRF into the bony defect. The primary objective in healing of surgical wound with large bony defect is the bone regeneration inside the defect to fill the cavity. Various surgical adjuvants include bone grafts materials such as autologous bone, allograft, alloplasts and xenograft (an organic bovine bone) and synthetic materials such as bioactive glass [9].

The ideal bone graft replacement material should be biologically inert, not carcinogenic, easily controllable to fill the osseous defect, and should be structurally stable. It should serve as a base for new bone formation and slowly resorb to permit replacement by fresh bone. The mechanism is only related to bone biology and the osteogenic properties of the various filling materials [10].

PRF allows cell migration and proliferation like a fibrin network. It is obtained from anticoagulant‐free blood harvest. Many growth factors such as platelet‐derived growth factor and transforming growth factor are released from PRF [11]. It is widely used in various fields of oral and maxillofacial, periodontal ear-nose-throat and plastic surgery. Its use in stimulating the healing of surgical wound with large bony defect created by radicular cyst was reported as surgical adjuvant along with allogeneic bone graft biomaterial. In the present case, autologous PRF and alloplastic bone grafting was done [12].

Due to the presence of different treatment approaches for the present case, multidisciplinary evaluation is always recommended to provide clarity in treatment planning. In the present case, the multidisciplinary treatment (Enucleation of the lesion, endodontic treatment, apical resections of the involved teeth, and all-ceramic crowns) was successful to save the affected teeth. Multidisciplinary approaches may conclude with much more successful results and higher patient satisfactions especially for complicated cases than alternative and more radical treatment options.

Conclusion

Based on the literature and the clinical case presented, it could be concluded that endodontic surgery when well indicated and performed in conjugation with root canal treatment using bone formation enhancing materials has a very favourable prognosis. The traditional endodontic treatment eliminates the infection inside the canal, whereas apisectomy with placement of autologous PRF and alloplastic bone graft eliminates the infection in the periapical area, allowing rapid neo bone formation. The use of autologous PRF with alloplastic bone graft as a surgical adjuvant is an innovative, economic method of promoting bone healing.

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