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Dilemma of root canal perforation repair-A case report

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Abstract: *Root canal perforation is an undesirable and apprehensive situation for the dentist, sinceit can significantly influence the root canal treatmentoutcome. The prognosis of the perforation repairdepends on variousfactors likelocation of the perforation, the time the perforation is open to contamination, the ability to seal the perforation, and accessibility to the main canal.Eventhoughmost of the cliniciansprefer non surgicalmethods for perforation repairusingdifferentnewerbiocompatible materials like MTA and Biodentin, certain situations warantee the need for surgicalintervention for favourable outcome and patient benefit.*
Key Word*: Root canal perforation, Biodentine, CBCT, Surgical Repair*

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I. Introduction

Mishaps during access opening significantly affect the long-term outcome of a root canal treated tooth.[5] One of the main goals of root canal treatment according to Schilder, is the avoidance of iatrogenic damage to the canal system and root structures and confinement of instrumentation to root canal. The first and arguably the most important phase of any nonsurgical root canal procedure is gaining proper access to the complex root canal system.[1,2]

A perforation is defined as a "mechanical or pathologic communication between the root canal system and external tooth surface and is usually associated with an iatrogenic event, accounting for about 10% of all non-healed cases.[5]Calcified canals, pulp stones, misplaced tooth, an extra-coronal restoration, intracanal posts, extensive carious lesions, resorption, or operator error occurring during root canal instrumentation or post preparation are some of the factors which can contribute to root canal perforations.[3]

The size of perforation, location, time of diagnosis and treatment, degree of periodontal damage, as well as the sealing ability and biocompatibility of the repair material are the major determinants of treatment prognosis of perforation repair.[4] The above factors also help the operator to determine whether to approach and treat the defect surgically or non-surgically.

The choice of the restorative repair material for internal non-surgical approach to the defect is based on, the ability to control moisture, accessibility to the defect and esthetic considerations.

MTA was and is still considered the best perforation repair material by many operators, and is used for nonsurgical and surgical perforation repairs. Remarkably, cementum grows over this non-resorbable and radiopaque material, thus allowing for a normal periodontal attachment apparatus.[6] But, in recent years, biodentine, a bioactive dentin substitute has gained popularity. It is a tricalcium silicate-based material similar to MTA but with no gypsum and less water. Biodentine combines the biocompatibility of MTA with many additional and desirable characteristics which includes bioactivity-inducing hard tissue formation, less hard tissue staining, good handling characteristics, self-adhesion to dentine, no shrinkage, a better antibacterial action and a shorter setting time than MTA (12–15 minutes).[7-10]

This paper reports a case of surgical repair of a failed nonsurgical management of buccal cervical third root surface perforation of maxillary right central incisor.

II. Case Report

A 22-year-old male patient was referred to the post graduate section of dept of conservative dentistry and endodontics from the undergraduate section after suspecting a root canal perforation which resulted during an attempted root canal access opening in relation to upper right central incisor.

Patient had no relevant medical history and appears to have normal physique for his age. There was dental history of root canal treatment followed by post and core and crown placement in relation to upper right

lateral incisors and upper left central incisors following dental trauma of upper anterior teeth region about 8 years back. Patient had reported to the hospital for treatment about 1week back with the chief complaint of dull intermittent pain and slight yellowish discoloration of upper right central incisor and gives history of initiating root canal treatment 4 days back.

Clinical examination revealed that right upper central incisor was sensitive to percussion and was nonvital with no visible intraoral soft tissue or gingival changes.

An immediate RVG image taken with a 40/0.02 gutta percha cone inserted into the suspected defect, confirmed a root canal perforation(Fig 1b). The length and width of the perforation was approximately identified. Electronic apex locator (Root ZX Mini apex locator (J. Morita, Japan) used, also confirmed the diagnosis.RVG image showed a narrow-calcified root canal which was unassessed. The access opening was done carefully using dental loupe to avoid communication with the perforation defect and RVG was taken to confirm the same. Working length was determined by using both electronic apex locator and radiographically and canal was worked following principles of biomechanical preparation and proper irrigation technique.

Since the defect was dry and no bleeding noted, the possibility and consequences of non-surgical internal perforation repair treatment option was explained to the patient and with his consent an internal perforation repair was done non-surgically with biodentine (Septodont Biodentin$^{TM)}$), after sealing the root canal with gutta percha. The accuracy of the filling was again confirmed using RVG image. Calcium hydroxide (RC Cal, Prime Dental, India) intracanal medicament was given and patient was reviewed after 1 week.

Patient reported after one week with symptoms reduced and since biomechanical preparation was done and canal was dry, the canal was obturated using lateral condensation method. Access cavity was sealed using Intermediate Restorative Material (Dentsply Sirona) (Fig 1c).

On the third day after completing obturation of the tooth, patient reported with severe pain and on intraoral examination an inflamed sinus opening was seen in relation to the labial gingiva of maxillary upper right central incisor (Fig 3a). Since no defects in both perforation repair and root canal treatment could be identified using 2-D RVG image, patient was asked to report after a limited CBCT scan of the tooth for a detailed analysis of the defect and the repair done.

The CBCT scan of the tooth revealed that the perforation had been sealed but there was a spicule of extruded foreign radiopaque material possibly, biodentine irritating the buccal gingival soft tissues(Fig 2c). Perforation was found to disrupt and invade the tooth attachment apparatus. Root resorption was noticed at the apical third with angular bone loss extending till the middle third.

Since the sinus opening was persisting and patient was in pain, a decision was made with the patient's consent to go for surgical intervention after explaining the procedure and its possible outcomes.

The surgical site was disinfected and local anaesthesia of the site was achieved with nasopalatine block using lignocaine with adrenaline 1:200000(Health Biotech Ltd, Solan,India). A full thickness buccal mucoperiosteal flap was raised from upper right maxillary canine to the left upper central incisor (Fig 3b). The perforation defect was identified. The exposed biodentine covering the defect was burnished and the extruded biodentine was removed and the granulation tissue debrided(Fig 3c). Thorough irrigation was done and the flap sutured back(Fig 3d). An analgesic and an anti-inflammatory drug were prescribed for 3 days. Oral hygiene instructions were given and patient was recalled after 5 days for suture removal.

Patient reported after 5 days for suture removal and seemed to be in comfort and the surgical site was seen to be healing well. Patient was reviewed after 3 months and the tooth was completely asymptomatic. Clinical and radiographic examination after 1 year showed that the area was completely healed and patient was free of all discomforts(Fig 3e).

III.Discussion

Gaining root canal access to the anterior tooth though considered as an effortless procedure by many experienced dentists, can sometimes be cumbersome one and can lead to iatrogenic errors. And one among these unforeseen mishaps is root perforation. Root perforation contributes to 9.61% of almost 15% of the failures related to errors in coronal cavity preparation and canal preparation.[3]

Improper search for root canal orifices can result in pulp chamber perforations. In teeth with severe calcifications pulp chamber may be extremely narrow and hence access opening in such tooth can result in missing the pulp chamber space and the pulp chamber floor perforation as was seen in the present case. Another reason for perforation can be incorrect angulation of the bur which can result in lateral perforations, mostly at the mesial or distal aspect of the crown.[3]

Iatrogenic perforations during treatment were found to result in significantly lower chance of periapical healing.[11,12]

Sinai proposed that the prognosis for a tooth with a perforation depends on the location of the perforation, the time the perforation is open to contamination, the ability to seal the perforation, and accessibility to the main canal.[16]

Seltzer stressed the importance of sealing perforations immediately since unsealed perforations are exposed to microbial contamination, which can result in damage to periodontium and ultimately bone destruction and downward epithelial migration.[24]Kvinnsland et al and Ford et al also reported the same and concluded that early repair of perforation defects can have a significant effect on success of perforation treatment.[22]

In the case discussed here, the defect size and location were approximately identified by using proven methods like radiovisuography image by inserting a 40/.02 size gutta-percha cone into the defect and electronic apex locator.[20] Root ZX mini apex locater was used for the same, since it had been proved to accurately determine the location of root or pulpal floor perforations.[21,23]

Microscopes, paper points, electronic apex locators, and diagnostic radiopaque contrast solution are useful in determining the level, location, and extent of a perforation and the potential for successful management.[13,14,23]

Since the defect was dry and no associated soft tissue and hard tissue changes was noted, the decision was to go for an immediate internal approach repair.[15]In this case, patient's aesthetic concern of potential gingival recession related to flap elevation, was also a secondary factor to decide on non-surgical management.

Different studies have shown the superior ability of CBCT in detecting perforative defects when compared to conventional imaging in terms of defect dimensions and location .[17.18,19] The location of the perforation is not so important when nonsurgical treatment is selected, but its position is critical if surgical approach is considered.

In the present case, the exact location, size and level of the perforation was not known due to lack of CBCT images since the clinician preferred early intervention for perforation repair. This was probably one of the reasons for biodentine extrusion through the perforation and failure of the non- surgical management.

The reasons for failure of non- surgical approach in this case can be possibly attributed to various factors like, lack of initial CBCT image of the defect, delayed repair of the defect after 4 days of exposure and extrusion of the perforation repair material.

IV.Conclusion

Even though root perforation repair by internal approach using newer bioceramic materials like biodentine, ProRoot MTA etc. have proved to be an easy, non-invasive, patient and operator friendly treatment modality, they do not warrantee the desired treatment outcome in all the cases. This leaves the dentist with the final decision to go for a surgical intervention for better treatment outcomes and patient benefits

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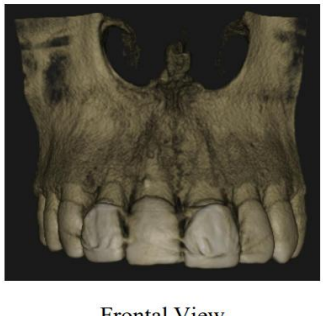
RADIOVISUOGRAPHY IMAGES

Fig.1a.RVG image showing theperforation defect after access opening

Fig.1 b. Perforation defect traced with gutta percha cone

Fig.1. c. Defect sealed with biodentine and obturation completed

CBCT IMAGES



Frontal View

Fig.2 a.Frontal view of the tooth,11 showing perforation defect in the buccal cervical third of root sealed with biodentine

Fig.2 b.Root canal treated 12,11&21, with post and core in relation to 12 &21

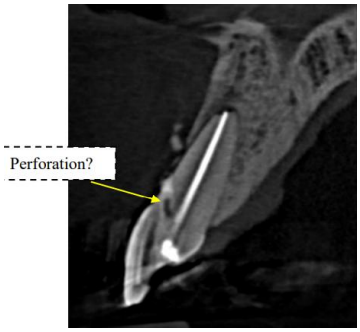


Fig.2 c.CBCT image of 11, showing the perforation defect communicating with periodontium and sealed with biodentine.

SURGICAL REPAIR

Fig.3 a.Inflamed sinus opening seen in relation to labial mucosa of 11

Fig.3 b.A full thickness mucoperiosteal flap raised and defect exposed

Fig.3 c.Biodentine burnished and granulation tissue curetted.

Fig.3 d.Flap repositioned and sutures placed

Fig.3e review after 1 year

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