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Sealing It UP With Chitosan - Case Reports on Sealing Furcation Perforations with Chitosan

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Abstract

Furcation perforations as a possible complication during a root canal treatment may increase the risk of failure for the affected tooth. The influencing factors include: the location and the size of the perforation, a potential microbial colonization of the endodontic system, the time lapse between the occurrence of the perforation and repair, and the filling material. Decontamination at the perforation site and in the remaining root canal system is essential for long-term success.

These case reports present the treatment of a mandibular second molar with apical periodontitis and iatrogenic furcation perforation in 15-year-old male patient and 21-year-old female patient. Miraculous results were found when chitosan used for perforation repair.

Keywords: Furcation perforation; Chitosan.

Introduction

- Iatrogenic perforation of pulp chamber floor is an undesirable complication in dental practice that can have a negative impact on the treatment prognosis.
- The size and location of the perforation as well as the time interval between the accident and its repair will influence prognosis.
- The ideal material for perforation repair should be antibacterial, non-cytotoxic, non-absorbable, biocompatible and able to induce formation of hard tissue, particularly cementum, over the material and also provide a three-dimensional seal.[1]
- A wide range of materials have been suggested for surgical and nonsurgical repair of perforations including zinc oxide eugenol, calcium hydroxide, Cavit, amalgam, glass ionomer, composite resin, mineral trioxide aggregate (MTA) & chitosan.

Case report

Case 1

- A healthy 21-year old female was referred to our department with a continuous dull pain in the left mandibular region, which had started after initiation of root canal treatment on the second molar by general dentist about two weeks before.
- The intraoral examination revealed that the tooth was sealed coronally with temporary cement.
- Tooth was sensitive to percussion and palpation.
- The mean probing pocket depth was within normal level (2 mm).
- Periradicular radiographic examination revealed a little radiolucent area in the furcal region of left second mandibular molar and apical radiolucencies from pulp necrosis were also observed [Figure 1].

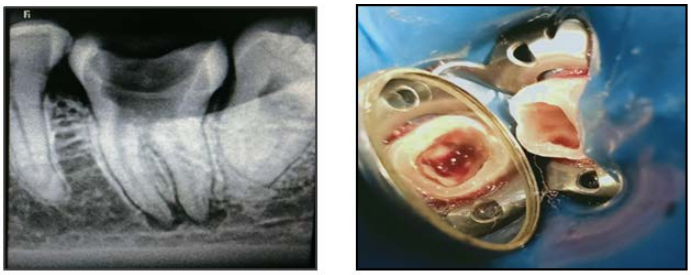

Figure 1: (a) Initial periradicular radiograph of a mandibular left second molar showing a large furcal perforation and apical radiolucencies in the patient; (b) Intraoral photograph showing root canal and a large furcal perforation.

- Treatment options which were indicated for the tooth were extraction and non-surgical repair of the perforation.
- As per the patient preference, the option of saving the tooth via a non-surgical procedure, that is, furcal perforation repair with chitosan was chosen.
- After the administration of local anesthesia 2% lidocaine with 1:100,000 epinephrine, the tooth was isolated with a rubber dam, the temporary restorative material was removed and the access cavity was prepared, and the perforation area could be clinically seen.
- Hemorrhage was controlled with copious irrigation with 0.9% saline solution.
- A cotton pellet was placed in the orifice of perforation.
- The working length was then checked by using an apex locator (Novapex, Fórum Technologies, Israel).
- The root canals were cleaned and shaped using rotary files (M2 files, DentsplyMaillefer, Ballaigues, Switzerland) in a crown-down technique.
- Before the use of each instrument, an irrigation of the canal was performed using a syringe (27-gauge needle) containing 1 mL of 2% chlorhexidine (CHX) gel (Endogel, Itapetininga, SP, Brazil),and immediately rinsed afterwards with 3 mL of saline solution.
- After the root canals were dried with paper points, they were obturated.
- For obturation, gutta-percha points were used and AH plus (Dentsply) was used as a root canal sealer.
- The root canals were then filled using the lateral condensation technique [Figure 2].

Figure 2: Periradicular radiograph of a mandibular left second molar showing obturated root canal.

- After the obturation of the root canals, the cotton pellet was removed from the perforation, exposing the site of the perforation.
- The furcal perforation was irrigated with saline solution & 2% chlorhexidine (CHX) gel.
- Chitosan (Inlife) placed into the pulp chamber with a cement carrier [Figure 3].
- It was then gently packed with a cotton pellet to obtain a good adaptability.

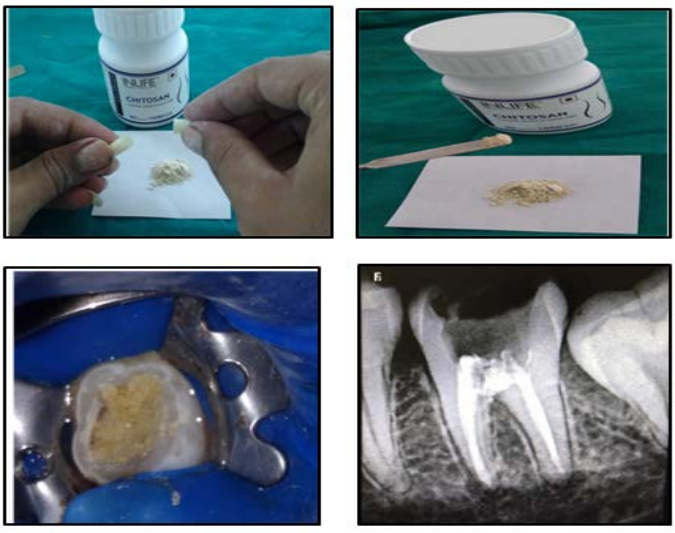

Figure 3: (a) Dispensing of chitosan powder after opening of capsule; (b) use of cement carrier for placing chitosan into the pulp chamber; (c) intraoral picture of Chitosan

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being placed into the furcal perforation; (d) Radiograph of chitosan being placed in to the furcal perforation.

- Afterward, the tooth was restored using glass ionomer cement [Figure 4].
- The patient was then referred for a permanent coronal rest

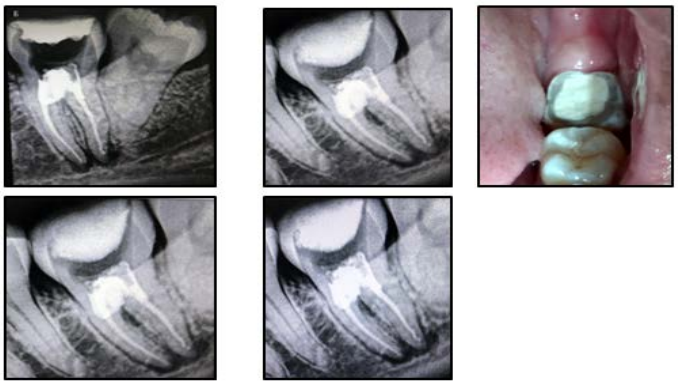

Figure 4 : (a) Radiograph of restoration with GIC; (b) Intraoral photograph of restoration with GIC; (c) 1 month follow up radiograph; (d) 3 months follow up radiograph; (e) 6 months follow up radiograph showing adequate sealing of the perforation region and no radiolucency at the furcal area in the mandibular left second molar of the patient.

- The clinical examination showed that the tooth had no pain, and no response to percussion, palpation and there were no attachment loss.

Case 2

- A healthy 15-year old male was referred to our department with a continuous dull pain in the left mandibular region, which had started after initiation of root canal treatment on the second molar by general dentist about two weeks before.
- The intraoral examination revealed that the tooth was sealed coronally with temporary cement.
- Tooth was sensitive to percussion and palpation.
- The mean probing pocket depth was within normal level (2 mm).
- Periradicular radiographic examination revealed a little radiolucent area in the furcal region of left second mandibular molar and apical radiolucencies from pulp necrosis were also observed [Figure 5].

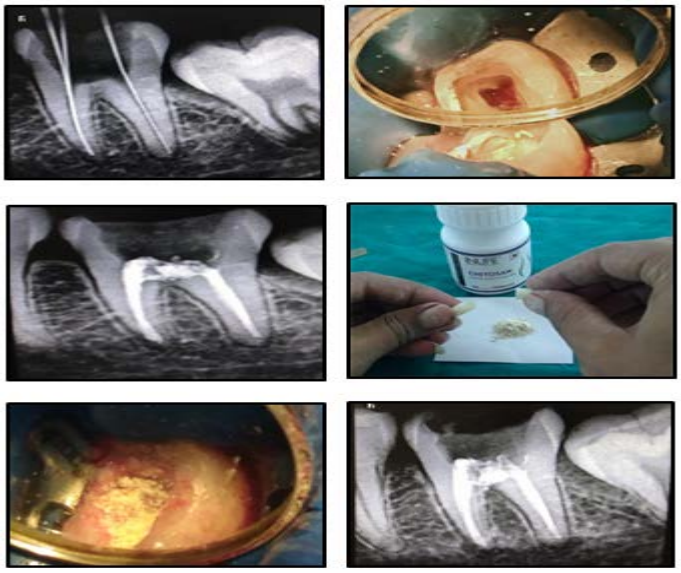

Figure 5 :- (a) Initial periradicular radiograph of a mandibular left second molar showing a large furcal perforation and apical radiolucencies in the patient; (b) Intraoral photograph showing root canal and a large furcal perforation; (c) periradicular radiograph of a mandibular left second molar showing obturated root canal; (d) Dispensing of chitosan powder after opening of capsule; (e) use of cement carrier for placing chitosan into the pulp chamber; (f) intraoral picture of Chitosan being placed into the furcal perforation; (g) Radiograph of chitosan being placed in to the furcal perforation.

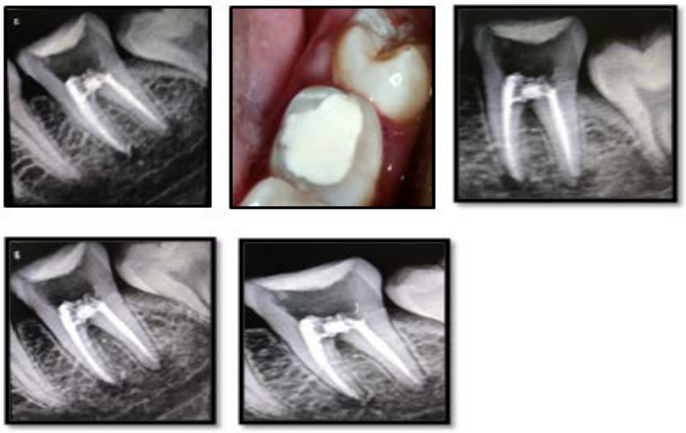

Figure 6 : (a) Radiograph of restoration with GIC; (b)

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Intraoral photograph of restoration with GIC; (c) 1 month follow up radiograph; (d) 3 months follow up radiograph; (e) 6 months follow up radiograph showing adequate sealing of the perforation region and no radiolucency at the furcal area in the mandibular left second molar of the patient.

- The clinical examination showed that the tooth had no pain, and no response to percussion, palpation and there were no attachment loss.

Discussion: Why Chitosan….?

- Chitosan, a naturally occuring polymer, is a highly versatile biomaterial. [2]
- It is derived from the shells of crustaceans, a natural & renewable source.
- In-vitro studies by Levengood et al. showed that chitosan has a Hydrophilic Surface that promotes cell adhesion & proliferation of OSTEOBLAST CELLS- promoting as well as forming a mineralized bone matrix- “Osteoinductive” & “Osteoconductive”.[3]
- Amidi et al. through their research concluded that chitosan accelerates wound healing by modulating the function of inflammatory cells such as Neutrophils, Macrophages, Fibroblast & Endothelial Cells.[4]
- Chitosan’s Cationic nature was studied by Tanka et al, & they concluded that, it bind to Negatively Charged Red Blood Cells thereby promoting clotting & wound healing.
- Because chitosan is cationic, it Disrupts Anions In Bacterial Cell Walls leading to suppression of biosynthesis & disruption of transport across the cell walls.[5]
- Alexander et al. studied the Highly Porous nature of chitosan, which allows for nutrient & waste transport, neovascularization & bone ingrowth.[6]
- Shows Adequate Mechanical Strength to support bone ingrowth & maintain structural integrity during in vivo tissue remodeling.[7]
- Degrades Over Time with bone regeneration without forming toxic end products.[8], [9], [10]
- The control of inflammatory processes in the defect area during the management of perforation represents one of the main goals of the treatment.
- To achieve a better tissue response, the perforation sites were disinfected with 2% chlorhexidine gel.
- In this case, we decided not to use sodium hypochlorite (NaOCl) because it is known that it can be extremely aggressive, and cause damage to the surrounding tissues.
- Chlorhexidine has been recommended by several authors as an auxiliary chemical substance, as, in addition to being relatively non-toxic when compared to NaOCl, it has excellent antimicrobial power and prolonged time of action.
- These properties may offer clinical advantages of using chlorhexidine in furcal perforations.

Conclusion

Chitosan has been used successfully in this study for perforation repair since it is able to induce formation of hard tissue, particularly cementum, over the material and also provide a three-dimensional seal.

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