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INFLUENCE OF CORONAL AND APICAL SEAL ON PERIAPICALTISSUE BIOLOGY- A ONE YEAR FOLLOW UP CLINICAL CASE REPORT

Dental Science

Dr. Mahaboob Shahul Hameed Post graduate student, SRM Dental College, Ramapuram, Chennai.

Dr. Vijay Amirtharaj. L Reader, SRM Dental College, Ramapuram, Chennai.

Dr. Kavitha Sanjeev* Professor, SRM Dental College, Ramapuram, Chennai.* Corresponding Author

Dr. Mahalaxmi Sekar Professor and HOD, SRM Dental College, Ramapuram, Chennai.

ABSTRACT

The complex root canal anatomy plays a significant role in success and failure of endodontic treatment. Any communication from the root canal system to the periodontal ligament space should be thought of as a portal of exit through which endodontic breakdown products pass. Endodontic failures must be evaluated to prevent further irritation through continued contamination of the root canal system. The ultimate success of endodontic therapy is achieved when an adequate apical seal as well as coronal seal is considered important. Moreover the assessment of failure must be studied so as to decide the options of non-surgical or surgical retreatment or extraction. If proper guidelines and case selection is considered for non-surgical retreatment procedures, potential for success is enormous. This paper presents a one year follow up case report of a 35 year old silver point obturation in the root canal system, and the effect of coronal and apical seal on the periapical status and its importance to increase the longevity of the tooth.

KEYWORDS

Apical seal, Coronal seal, Corrosion, Re-treatment, Silver points

INTRODUCTION

For decades it's been accepted that one of the main cause of continued endodontic infection is the lack of apical seal due to inadequate obturation.[1] However, the absence of coronal seal equally has an impact on the ultimate outcome of endodontic treatment.[2] It's been stated that adequate coronal restoration and canal obturation in density as well as length and completely sealed portal of exit prevents the bacterial penetration impacting the apical health.[3] Though the current strategy is to ascertain that the predominant cause for endodontic failure is mainly due to inadequacy of both coronal and apical seal, there are abundant literature dogged by controversy. The main focus of American Association of Endodontics is to achieve highest quality of care in the practice of endodontics. The AAE implements and supports the use of safe and effective materials during all phases of endodontic treatment. Though it does not endorse the use of specific materials; it does not recommend the continued use of silver points, as they have proven to have inadequate apical seal and corrode over time which again compromises the apical seal.[4,5] Ironically, there has been extensive research on silver points, and the results of the search discourages its use as a root canal filling material. But despite the fact that the success of any root canal filling material depends on the ability to fill the entire root canal space three dimensionally, the relative ease of use and dense radiographic appearance gives a false sense of satisfaction. This paper represents a one year follow up case report of upper anterior teeth with Ellis class III and silver points obturation and its influence on periapical health status due to inadequate apical and coronal seal.

CASE REPORT

A 54 years old male patient reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of fractured and discoloured upper front tooth since 5 years. Past dental history revealed root canal treatment for both the upper central incisors 35 years ago. Clinical examination revealed Ellis III fracture of upper left central incisor-21, discoloration around the exposed root canal filling material suggestive of the silver points, periodontal probing depth within normal limits, no mobility and negative to tender on percussion. Based on the patients history there seems to be loss of coronal seal for more than 10 years. Class IV cavity was observed in 11 with the greyish to blackish discoloured crown with the entrance filling in the access cavity as shown in (Fig-a). Class V lesions were observed in few of the upper and lower teeth.

Radiographic examinations revealed radio opaque filling materials which were incompletely obturated terminating 3 mm short of the apex suggestive of guttapercha and silver points in 11&21 respectively (Fig-b). Based on the clinical and radiographic findings loss of apical seal with incomplete obturation and asymptomatic apical periodontitis was observed in 11. 21 was diagnosed having a dense root canal obturation with apical resorption and periapical radiolucency suggestive of periapical pathology. The dense appearance could be due to the radiopaque nature of the silver points giving a three dimensional look, though it does not achieve the same. Patient was explained about the existing condition and non-surgical retreatment with post endodontic management was recommended. 21 were treated first followed by 11, based on the patient needs and financial reasons.

Following rubber dam isolation, the canal of 21 were re-entered and the existing silver points were removed using ultrasonic vibration and mosquito artery forceps (Fig-c). Confirmatory radiograph was taken to check the complete removal of root canal filling material. The canal was cleaned and shaped using step back technique with the master apical file no 60 K-size file. The canal was intermittently irrigated alternating with saline, 3% sodium hypochlorite and 2% chlorhexidine being the final irrigant. After drying the canal with paper points, ApexCal (Ivoclar Vivadent, Liechtenstein) a calcium hydroxide based intracanal medicament was placed in the canal and temporized with reinforced zinc oxide eugenol cement. Following one week recall, the patient was asymptomatic and was obturated with AH plus sealer and guttapercha using lateral condensation technique followed by temporization with reinforced zinc oxide eugenol. In the subsequent visit, post space was prepared with peeso reamers up to size 3 and appropriate fibre post was selected and cemented using dual cure resin cement (Fig-d). Light cure composite core build up was done using Filtek 350 XT. Following tooth preparation, all ceramic crown was fabricated using CAD-CAM technology. The crown was then luted with resin cement. Subsequently after completing 21, the root canal filling material in 11 was removed using hand files/rotary/solvents and similar root canal treatment protocol was followed as done for 21. As a post endodontic management, following crown preparation, all ceramic crown was fabricated using CAD-CAM technology and luted with using resin cement (Fig-e). After the follow up period of 1,3,6 &12 months, the patient was asymptomatic and radiographic findings revealed regression in the periapical radiolucency suggestive of healing (Fig-f).

DISCUSSION

Despite the high success rate of endodontic treatment, failures do occur. Myriad of factors are associated and mostly it is attributed to leakage, bacterial contamination or recontamination due to inadequate apical and coronal seal.[6] A study which assessed teeth with endodontic failures, reported 65% of the cases with poor quality obturation and the success rates were the lowest when the obturation terminated 2mm short of the apex.[7,8] These findings relates to the findings of the present case report in which 11&21 obturated with gutta-percha and silver points failed to achieve three dimensional obturation and apical seal due to under filling. These observation can be correlated to Segura-Egea et al who stated the there was an increase in incidence of periapical pathologies when the obturation was inadequate or under extended.[9] Further, the formation of corrosion products from silver points due to contact of tissue fluids in 21 could have aggravated the existing condition leading to chronic periapical pathology[5]

The concept of coronal leakage causing endodontic failure is a well-known fact. Marshall and Massler in the year 1961 hypothesized the outcome of endodontic treatment based on the occlusal seal.[10] Torabinejad et al observed that 50% of the entire length of the canals contaminated in 19 days, when exposed to various microorganisms. [11]

Ray and Trope in the retrospective study concluded that the percentage of success in endodontic treatment, depends on the quality of the coronal restoration and the root canal treatment.[12] Thus, as stated by the literature, fracture, loss of temporary/permanent restoration contaminate the obturated root canal and its preferable to restore and seal the tooth as early as possible after endodontic therapy to prevent coronal leakage and to improve their long-term success rate. [12,13,14,15] As far as this case is concerned, the of coronal seal was lost due to fracture and the canal space was left open for 5 years. Coronal leakage may go unnoticed for months because it's a silent killer and patients do not experience pain or sensitivity. It advances in unobtrusively causing extensive damage. [16] The occurrence of chronic periapical pathology in this case could be correlated to the absence of coronal seal for many years.

Though surgical and non-surgical retreatment is an option in such conditions, Ruddle claims 85% success rate for non-surgical endodontic retreatments, and clearly states that, it rarely fails again when the existing problem is neglected or overlooked.[17] Hence non-surgical retreatment was opted understanding the cause of the failure,and what is hoped to be accomplished by retreatment.

During retreatment of silver point obturated root canals, separation of silver points should be avoided. Though it is poorly adapted in the coronal third of the canal, it may adapt well in the apical third, hence, just grasping the exposed coronal aspect without any preparation would pose a risk of fracture. In this case report ultrasonic instruments were used indirectly by placing a 10 size H-file down into the canal along the side of the silver points. Lowest power setting was used to efficiently and safely remove the silver points without breakage.

Obturation with silver points was originally introduced in 1930's due to their simplicity of placement and rigidity.[18,19] But later reports showed that electrochemical corrosion occurred and that the byproducts were highly cytotoxic.[19,20,21] During retreatment procedure, when the silver points were removed, a black sediment was noted. This sediment has been reported in the literature to be cytotoxic, which is believed to initiate or support inflammatory reactions.[21,22] Hence additional time and resources were spent to assure that much of these corrosive material is removed, so as to make the environment conducive for healing. Hence to debride the canal completely intracanal medicament with calcium hydroxide was placed for a week. The calcium and the hydroxyl ions encourages repair due to high pH and it neutralizes lactic acid from osteoclast and prevents dissolution of the mineralized components of the teeth.[23] It diffuses to the inaccessible areas and may communicate with the periodontal ligament space to accelerate healing.

Although periapical healing starts after root canal cleaning, shaping and disinfection, it is an accepted scientific fact that good obturation is needed for it to stay healed over the years.The main focus was to obtain a three dimensional obturation with a proper apical and coronal seal and to rehabilitate the anterior teeth to proper form and function.[24] Obturation plays an important role in preserving the environment created by shaping and cleaning and preventing microbial reinfection of the canal space, which is essential for securing long term peri radicular health.[25] Cold lateral condensation technique was done in this case which has withstood the test of time.

Due to insufficient tooth substance remaining to support the final restoration and the predominant shear forces in the anterior tooth, it is being suggested that a post should be used to counteract and to serve as a retention for core which further supports the coronal restoration. [26]

In anterior teeth when the remaining coronal tooth structure is less, post and core is often indicated to resist lateral and shearing types of forces and to support the final restoration. [26] Hence only crown in 11 and fiber post and core followed by crown was opted. Fiber-reinforced posts offer increased flexure and fatigue strength. When comparing the modulus of elasticity of the available posts, only FRC post is close to that of dentine, and has the ability to form a single bonded complex within the root canal. It is one of the best choice when placed under all ceramic restoration due to improved esthetics when compared to metal post. [27,28] Several studies have reported that the failure rates are only 3.2% with fiber posts and have concluded it to be ideal when used in anterior teeth.[29] The construction of a core build-up is necessary as the amount of residual tooth substance decreases. The resin based composite which has good strength and low solubility offers an esthetically suitable material especially when an all ceramic restoration is the choice for an anterior tooth. [30]

It is generally agreed that the successful treatment of a badly broken-down tooth with pulpal disease depends not only on good endodontic therapy, but also on good prosthetic reconstruction of the tooth once the endodontic therapy is completed. Hence it is becoming an integral part of the restorative practice. Because, though cold lateral condensation appears ideal in the radiograph, a proper coronal seal is mandatory to prevent micro leakage. Swanson and Madison et al emphasized the importance of proper coronal restoration to prevent ingress of any microorganisms which would otherwise lead to failures.[31]

A coronal restoration with good margins that prevent bacterial ingress suggests that a normal state of periapical health can be achieved.[32] CAD-CAM technology and metal free materials have been opted in the recent years due to excellent marginal fit and durability.[33] Tooth like appearance due to its commendable translucency have been their greatest advantage.

The radiographic evaluation is a valid assessment tool and is considered to be of greater importance than quality scoring by clinical assessment for periapical status.[34] Hence in this study radiograph was used to evaluate the periapical changes. A one year follow-up of this case showed regression of periapical lesion radiographically with absence of signs and symptoms of pain, this could be correlated to the adequate apical and coronal seal provided which may have created a conducive environment for healing to occur. [12,34,35]

To conclude, comprehensive treatment planning often involves decisions concerning the need for, and advisability of endodontic treatment, which further depends on the position of the tooth in the arch, amount of tooth structure remaining, and the functional demands anticipated. A well-sealed coronal restoration and well performed root canal treatment is the cornerstone of restorative and reconstructive dentistry. The importance of both should be emphasized as it is a prerequisite for long term success because the ultimate dental implant would be the naturally retained root.

Fig-a Preoperative image of 11&21.

Fig-b Preoperative radiograph of 11&21.

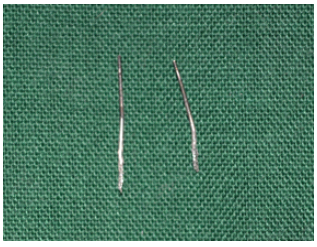

Fig-c Retrieved silver points.

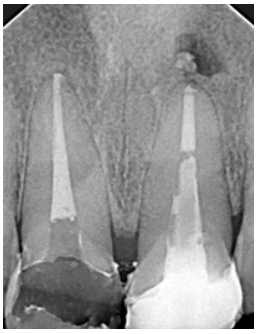

Fig-d Postoperative radiograph of 11&21.

Fig-e Postoperative image after post endodontic restoration of 11 & 21

Fig-f Postoperative Radiograph - One year follow up of 11 & 21

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