ABSTRACT

The purpose of this article was to report the successful nonsurgical endodontic management of mandibular first premolar with unusual anatomy and hypercementosis that was not reported elsewhere before and the challenges that were faced while determining the apical stop and preparation of apical part of the canal.

A 25-year old Saudi male patient reported to referral hospital, with chief complaint of continuous pain in lower right quadrant for 2-3 days. His medical history was non-contributing. Clinical examination revealed a carious lesion on the mandibular right first premolar. The pain was of acute in nature but was not tender on percussion. Interestingly unique pattern of the canal system was found on periapical radiographs which resembled configuration of Vertucci type V and hypercementosis at the apex of the tooth.

In this case while performing the endodontic treatment two very important challenges were faced. The first one was to determine the working length as the apices of tooth were hindered by hypercementosis and other one was to prepare the apical part of canal adequately without file separation that was obstructed by hypercementosis. Determination of working length was challenged as there was no definitive apex found on the digital radiographs and also variable readings were found with the apex locator, therefore the image was magnified and contrast with different color scheme with the help of digital imaging software (Vatech) in order to determine the radiographic apical preparation stop. Following the working length determination, the root canals were prepared with a crown down technique and the great resistance were noticed in apical part of canal due to hypercementosis, therefore the apical preparation was finished at proptaper finishing file (F 1) and obturated with lateral condensation.

This case describes a mandibular premolar with an unusual anatomy and pathology. Coronally the single canal is divided into two canals in mid-root that terminate into separate apical foramens, but presence of excessive cementum at apex of root hindered the apex on radiographs, thus apical termination point of endodontic instrumentation was difficult to evaluate and also the apical part of canal was hard to prepare, owing to hypercementation.

Key Words: Hypercementosis.

INTRODUCTION

The main objective of endodontic therapy is to restore the treated tooth to its proper form and function in the masticatory apparatus. Knowledge of the normal or unusual possible configurations of the pulp and root morphology along with proper determination of working length of the root canals are of utmost importance in the endodontic treatment success and prognosis. A lack of knowledge of internal anatomy and its variations will undoubtedly lead to an error in localization, instrumentation and obturation of root canal and therefore the prognosis.
Hypercementosis refers to an adaptive change in the periodontal ligament, characterized by increased cementum thickness on the root surface which is above and beyond the extent necessary to fulfill its normal functions and therefore resulting in abnormal thickening with macroscopic changes in shape. The incidence of hypercementosis is not well established and the available data in the current literature suggests an incidence of 3.8% to 8.4%.

The causative factors considered for hypercementosis are many pathological and physiological conditions, such as reactionary response to periapical inflammatory processes, various types of trauma, developmental disorders during physiological cementum deposition and physiological continuous dental eruption. Masticatory function and tensile forces are assumed to play an important role in stimulating cementum deposition. However, completely impacted teeth without any functional stimulation are reported to exhibit thicker cementum layers, implying that functional loading is not necessarily a stimulus for cementum apposition.

Furthermore, systemic factors

<table>
<thead>
<tr>
<th>Root canal Description</th>
<th>Configuration</th>
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<tbody>
<tr>
<td>Type I</td>
<td>One root canal extending from the pulp chamber to the apex.</td>
</tr>
<tr>
<td>Type I</td>
<td>Two separate root canals leave the pulp chamber and join short of the apex to form one canal.</td>
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<tr>
<td>Type III</td>
<td>One root canal leaves the pulp chamber before dividing into two within the root, which then merge to exit as a single canal.</td>
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<tr>
<td>Type IV</td>
<td>Two separate root canals extend from the pulp chamber to the apex.</td>
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<tr>
<td>Type V</td>
<td>One root canal leaves the pulp chamber and divides short of the apex into two separate and distinct canals with separate apical foramina.</td>
</tr>
<tr>
<td>Type VI</td>
<td>Two separate root canals leave the pulp chamber, merge in the body of the root, and again divide short of the apex to exit as two separate and distinct canals.</td>
</tr>
<tr>
<td>Type VII</td>
<td>One root canal leaves the pulp chamber, divides and rejoins within the body of the root, and finally re-divides into two distinct canals short of the apex.</td>
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<tr>
<td>Type VIII</td>
<td>Three separate and distinct root canals extend from the pulp chamber.</td>
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Endodontic treatment of premolar

<table>
<thead>
<tr>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
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<th>Type 5</th>
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<td>1-1</td>
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<td>2-1-2</td>
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<td>3-3</td>
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</tbody>
</table>

Vertucci 1984

*Fig 4: Summary of root canal configurations according to the Vertucci classification*

like atherosclerosis, acromegaly, deforming arthritis, hypertrophic arthritis, thyroid diseases, and Paget’s disease have been described to be associated with the occurrence of hypercementosis. In addition, cementoblastoma must also be taken into consideration as a differential diagnosis. The characteristic radiographic appearance of hypercementosis is thickening of the cementum layer along with blunting or rounding of the root tip with various expressions of the trait from mild to severe. The biological width between the root surface, the alveolar bone and the periodontal ligament is found intact on the radiographs. Usually hypercementosis is associated with lack of pain and is an incidental finding on radiographs, and requires no further treatment however, if the endodontic treatment of the tooth is required it may pose great difficulty and might necessitate surgical intervention. The purpose of this article is to report the successful nonsurgical endodontic management of mandibular first premolar with unusual anatomy and hypercementosis which is not reported elsewhere before.

**CASE REPORT**

A 25-year old Saudi male patient reported to referral Hospital, with chief complaint of continuous pain in lower right side for 2-3 days. Signs and symptoms as described by patient included severe sensitivity to cold water or air that lasted for more than 15 minutes with lingering behavior. His medical history was non-contributing. Clinical examination revealed a carious lesion on the mesio-occlusal surface of the crown of mandibular right first premolar. The tooth was not tender on percussion and pain was of acute nature. Pulp vitality testing using electric pulp tester yielded a response at a higher current level than the adjacent and contralateral teeth that were clinically normal. Pre-operative radiograph of the tooth revealed a mesio-occlusal carious lesion encroaching the pulp without any radiographic signs. Interestingly the unique pattern of the canal system (Fig 1) was found which resembled configuration of Vertucci type V 9 and hypercementosis at the apex of the tooth. Based on the clinical and radiographic findings, a diagnosis of irreversible pulpitis was made and it was decided to carry out endodontic therapy of the tooth, followed by crowning. Although CBCT, that is the new and definitive diagnosis of pulpal or periradicular disease was required as a part of investigation but unavailability of CBCT technology in the hospital compelled the definitive diagnosis to be made according to the periapical x-ray findings.

The treatment plan was explained to the patient and after obtaining his consent, the tooth was anaesthetized using 2% prilocane with falypresin. The tooth was isolated with rubber dam and the access cavity was made with carbide burs. While performing the endodontic treatment two very important challenges were faced. The first one was to determine the working length as the apices of tooth were hindered by hypercementosis and other one was to prepare the apical part of canal adequately without file separation that was obstructed by hypercementosis. After initial extirpation of the pulpal tissue, working length was established by radiographic method and also by means of an apex locator (I-pex). Determination of working length was very challenging, as no definitive apex was seen on preoperative radiographs and also variable readings were found with the apex locator therefore apical preparation was stopped at most apical part as shown on radiograph (Fig 2). As the digital radiographs were used in this case therefore the image was magnified and contrast with different color scheme with the help of digital imaging software (Vatech) in order to determine the radiographic apical preparation stop. Radiographs showed two endodontic files, one in mesial canal and the other in the distal canal. Following the working length...
The root canals were prepared with a crown down technique by using proptaper rotary files till finishing file 1 (Fig 1) using copious irrigation with 5% sodium hypochlorite solution. As great resistance was noticed while using F 1 file on endodontic motor (X-Smart) hence apical preparation was finished at F 1 file in order to prevent bigger files to separation in canals. After completion of cleaning and shaping, the root canal system was obturated with cold lateral compaction of gutta percha cones along with resin-based sealer (AH plus). The coronal access cavity was restored with composite restoration (Fig 3). The patient was advised for recalls after one and then six months, to determine the prognosis, but unfortunately despite of several recalls patient didn’t responded.

**DISCUSSION**

This case report illustrates unusual morphology of the roots and root canal systems of a mandibular premolar with hypercementosis in an adolescent patient. The most common reason for failure of endodontic treatment is presence of an untreated canal or missed canal. A canal may be left untreated because of the clinician’s negligence to recognize its presence or lack of knowledge of aberrant root canal anatomy as it is very important to visualize and to have knowledge of internal anatomy relationships before undertaking endodontic therapy in order to ensure superior successful prognosis. A great variation can be found in the literature with respect to the root and root canal morphology of teeth and the human mandibular first premolar is no exception. The anatomies of mandibular premolars have been examined extensively and it is a fact that the root morphology of mandibular first premolar can be highly complex and the chance for an extra root(s) cannot be ignored. Normal root and root canal anatomy of the mandibular premolar is well documented in numerous textbooks, but there is a great deal of variation in the reporting of the incidence of anomalies. The factors that can contribute to differences observed in the various anatomic studies have been reported previously, and these factors include ethnicity, age, and gender. Vercutti has classified root canal configuration into eight types and is described in Fig 4 and Table 1.

Scott and Turner have also described the accessory root of mandibular first premolar as Tome’s root. Vertucci determined the incidence of a second canal in mandibular first premolars to be 26% and 3% for second premolars. The prevalence of lateral canals was 44% for the first premolar and 48% for the second premolar. The incidence of an apical delta in these teeth was 9%, whereas the ratio of apical foramina was 85% for the first premolar and 84% for the second premolar.

Few case reports that describe two or more roots or canal systems in mandibular premolar teeth are found in the literature. However, the complex nature of the root and root canal morphology of the mandibular premolars has been underestimated. The following clues from diagnostic information and techniques might help clinicians to detect additional root(s) and canal(s). A second radiograph from 15° to 20° from either mesial or distal from the horizontal long axis of the root is necessary to accurately diagnose the number of roots and canals in premolar teeth. Coned beam computerized tomography (CBCT) has gained popularity in the study of hard tissues and also used to confirm the variations in the root canal anatomy in recent years. The successful use of CBCT in dentistry has already been reported by Robinson et al and Sponchiado et al.

The prevalence of hypercementosis of teeth is not well established and the available data in the current literature range from 1.7% to 3.8% and even up to 84%. The increased thickness of cementum does not represent a disease, and normally no treatment is necessary. Still, if any treatment procedure for diseased teeth, associated additionally with hypercementosis are indicated, these may present problems for various reasons. Huge amounts of additional cementum formation may prevent a regular extraction, and surgical extraction may become necessary. Root canal treatment of these teeth can be challenging because it is still unclear whether limiting root canal instrumentation and obturation should occur above or beyond the cementum-dentin-canal junction in teeth with hypercementosis. Studies regarding the impact of hypercementosis on root canal treatment and its prognosis are still lacking. The apical limits for root canal preparation depend on different reference landmarks, and hypercementosis might impair such decisions. These morphologic features might elucidate the difficulties in estimating the working length radiographically in hypercementosed teeth and consequently so far, a common consensus regarding the apical limit of instrumentation and obturation is not yet available, and further studies investigating this particular aspect are encouraged.

By observing teeth with hypercementosis, Pinheiro et al highlighted that endodontist may experience difficulty to reach towards adequate shaping and filling of the canals because the cementum may be not permeable to endodontic instruments. It is important to highlight in this regard, that root canal shaping and filling below the adequate limit might cause the retention of either a contaminated area or inflamed tissue within root canal, leading to endodontic treatment failure. Therefore, it is stated that, clinically hypercementosis may directly influence on root canal treatment because the clinician needs to know the limits for root canal shaping and filling. In this study, working length, as established by radiograph and apex locator, ends at the beginning of the cementum canal. This is in accordance with the
description by Siqueira et al. who described the beginning of the cementum canal as the narrowest area of root canal which is divergent to tooth apex; even its clinical and radiographic determination is not viable because it is highly inconsistent regarding to tooth apex of several teeth. Similarly Pinheiro et al. stated that most of root apexes of teeth presenting mild and diffuse hypercementosis did not show irregularities and resorption, but they had a greater number of foramina. Moderate hypercementosis cases presented more irregular areas and also foramina presence. In severe hypercementosis, the authors found obliteration of root apex which limited the working length.

**CONCLUSION**

This case describes a mandibular premolar with an unusual anatomy and pathology. It is characterized by the presence of two canals in a single root. Coronal, a single canal is observed which divides into two canals (mid-root region), terminating into two separate apical foramina. Furthermore, the presence of excessive cementum at apex of root hindered the apex on radiographs and apical termination point of endodontic instrumentation is found challenging to evaluate, as instrumentation is one of the key factors in the success of endodontic therapy and also the apical part of canal is hard to prepare, owing to hypercementation, therefore, the clinician should be aware of the incidence of these extra canals in the mandibular premolar, as were found in the said case. The clinician must also thoroughly examine the pulp chamber, canals and associated pathology to ensure complete debridement of all the root canal system which might increase the chances for long-term successful endodontic therapy.

**REFERENCES**


**CONTRIBUTION BY AUTHORS**

1. **Nouman Noor:** Main article writer.
2. **Manzoor Ahmed:** Supervisor.
3. **Nusrat Jabeen:** Helped in data analysis.
4. **Sadaf Humayoun:** Helped in methodology.