International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2014): 5.611

The ‗C' Shaped Canal in Mandibular Second Molar and its Management Using CBCT: A Report of Two Cases

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Abstract: ***Aim: To Report the Diagnosis And Management Of A Case Series Of C Shaped Canals In Mandibular Second Molars. Summary: A thorough knowledge of the root canal morphology is required for successful endodontic therapy. Coupled with information gleaned from preoperative dental radiography, the clinician can assess to a great extent the anatomic challenges in each tooth. Although not all-encompassing, preoperative radiographs might aid in visualizing and observing the main anatomy of various root canal systems. One of the most important anatomic variations is the "c" shape configuration of the canal system. C shape canal presents an extensive complex system and is mostly seen in mandibular second molars. The c-shape configuration presents a challenge to debridement and obturation. This paper reports two cases of „c" shaped canal in the mandibular second molar which were diagnosed and managed successfully.***

Keywords: Cshaped Canals, Mandibular Second Molar, Cone Beam Computed Tomography

1. Introduction

A thorough knowledge of the root canal morphology is required for successful endodontic therapy. The prospect of the treatment depends on accurate diagnosis followed by location, cleaning and shaping and finally obturation of the root canal system. A good obturation is possible only after meticulous cleaning and shaping which eventually and ultimately depends on the clinician's knowledge and ability to comprehend, visualize, perceive and prepare the root canal system.

Root canal treatment has transformed remarkably since the hollow tube theory was postulated in 1930. Research into the morphology of the pulp has revealed that the dental pulp takes many intricate shapes and configurations before reaching the tooth apex. From the early work of Hess and Zurcher[1] to the contemporary studies regarding the anatomic complexities of the root canal system, it has been well established that the root with a graceful tapering canal and a single apical foramen is an exception rather than the rule. Investigators have very commonly encountered bifurcating canals, multiple foramina, fins, deltas, loops, cudle- sacs, inter-canal links, C-shaped canals and accessory canals in most teeth.

Cooks and Cox [2] first discovered the C-shaped anomaly in mandibular second and third molars in 1979. The presence of a C-shaped canal prevents effective cleaning, shaping and obturation during a root canal therapy. There are two common possible outcomes for the C-shaped mandibular molar (1) those that exhibit a single, ribbon like, C-shaped canal from orifice to apex and (2) those with three distinct canals below the C-shaped orifice, the more common form [3].

The C-shaped canal has been observed in mandibular first premolars, mandibular first, second and third molars, maxillary first molars and maxillary second molars.

As it is rightly said "everything has changed in endodontics except the pathways of pulp"[4]. As a professional, one should be aware of all the probable nooks and crannies of the complex root canal, its protean permutations and combinations, to render the finest possible treatment.

This paper describes successful management of two unusual cases of Cshaped canal using CBCT.

2. Case Report

CASE 1: A 36 year old male patient reported to department of conservative dentistry and endodontics, Al badar Dental college, Gulbarga, with chief complaint of pain in mandibular second molar. The intraoral examination showed badly decayed, tender mandibular second molar which was indicated for root canal treatment. On opening the root canal and removal of tissue from the pulp chamber the canal system appeared ‗C' shaped. Deep orifice preparation was done and careful probing with small files characterized the C- shape more accurately. The working length intraoral periapical radiographs revealed the canal as, Melton's category II. This was further confirmed by computed tomography . Biomechanical preparation was done. In these cases Gates Glidden drills should be avoided. There is a higher risk of root perforation at the thinner lingual walls of the C shaped canals during shaping. 5.25% sodium hypochlorite was used in a larger quantity, alternately with ultrasonics. This helped to remove tissues from the narrow canal isthmus, sealer application was done with lentulospiral

and obturation was done with sectional method and backfilling with thermoplasticized technique.

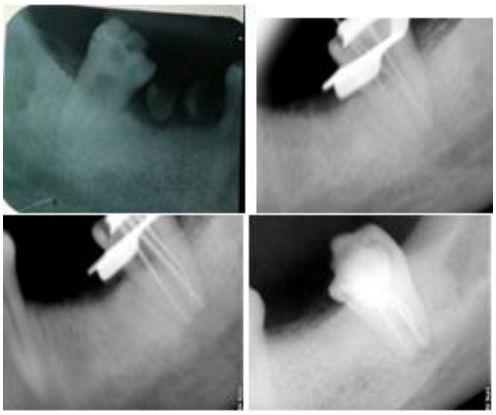

Figure 1: A) Pre operative, **B)** Workinglength , **C)** Mastercone **D)**Post Obturation

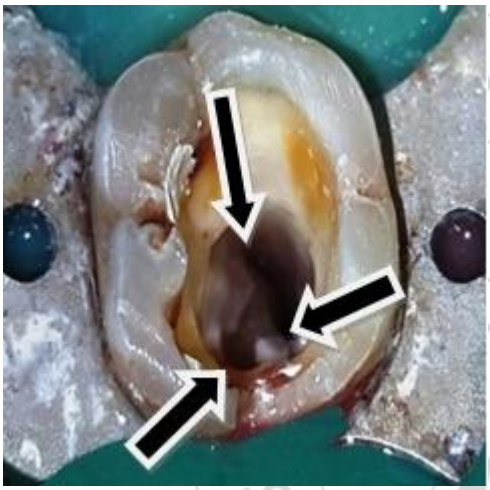

Figure 2: (SOM) occlusal view interpreting c shaped semicolon type canal – class II

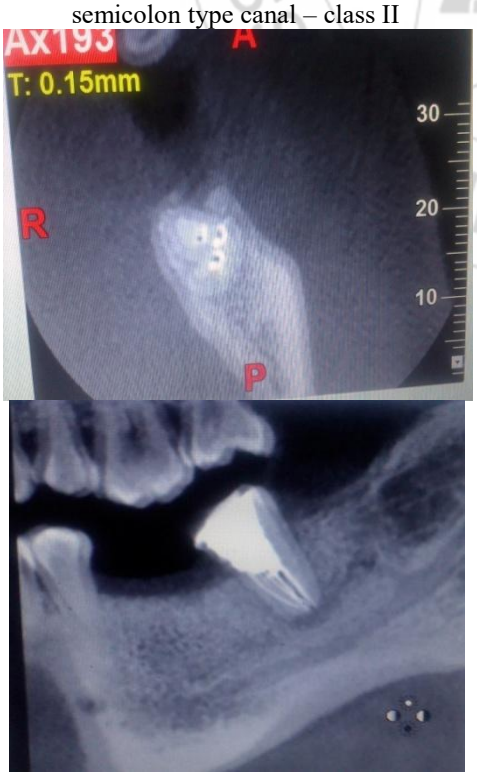

Figure 3: A) cross sectional view interpretting the C-Shaped canals **B)** Multiplanar view

Figure 3: Three dimensional post obturation view in cbct

CASE 2: A 23 year old female patient reported to Department of Conservative Dentistry and Endodontics, albadar Dental College & Hospital, gulbarga, with a chief complaint of pain in lower right back region of jaw since a month The patient‘s medical history was not contributory. Intra oral examination revealed deep occlusal caries with right mandibular second molar (i.e. 37) The tooth was tender to vertical percussion.Radiographic examination revealed single conical root with deep occlusal radiolucency extending to the pulp with absence of peri-radicular changes radio-graphically .Vitality testing showed negative results. Diagnosis was made as chronic apical periodontitis. Patient was informed regarding endodontic treatment and written consent was taken. Tooth was anesthetized by using 2% lignocaine containing 1: 20,000 epinephrine(LIGNOX 2% A).The endodontic access cavity was prepared under rubber dam isolation. The pulp chamber was irrigated with 2.5% sodium hypochlorite to debride the chamber fully and to identify the nature of the canal system under dental operating microscope10x magnfication (fig 2).The pulpal floor showed one mesial orifice & a broad C-shaped distal orifice resembling semi-colon type morphology revealing the canal as, Melton‘s category II.. Working length was determined using apex locator (Dentaport ZX, J. Morita Japan) and confirmed radiographically (fig 4). Cleaning and shaping was done with Heroshaper Rotary system. After removal of smear layer using 17% of EDTA, final irrigation was done with 2.5% of sodium hypochlorite. The canals were dried with absorbent points. A.H Plus sealer was placed and obturation was carried out using warm vertical thermoplasticized gutta-percha technique . The tooth was then restored with a posterior composite core (Z 100;3MDental products). The patient was advised to accept a full coverage crown and tooth was asymptomatic during the subsequent follow–up period

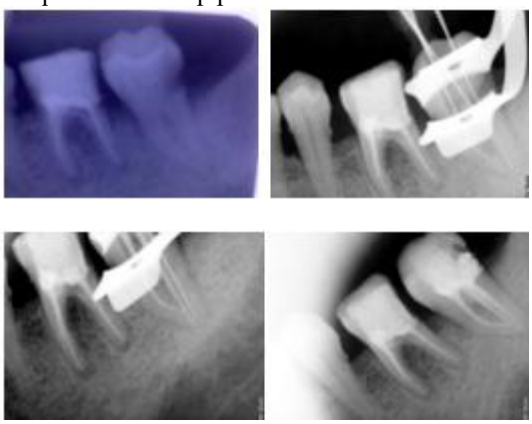

Figure 1: A) Preoperative **B)** Working length **C)** Master cone **D)** Post obturation

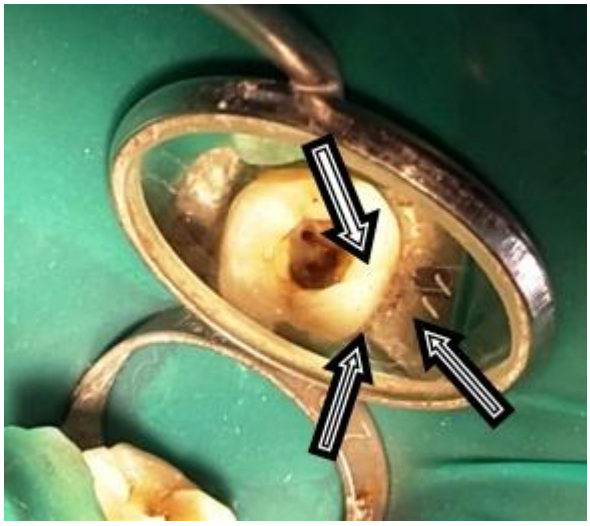

Figure 2: (SOM) occlusal view interpreting c shaped semicolon type canal – class II

3. Discussion

There are multitude pathways connecting the root canal orifice and the apex of the tooth running through the root dentine. Weine [6] categorized the root canal system in any root into four basic types. Vertucci et al. [7] categorized the root canal system into a more complex eight configurations . Interestingly the only tooth to demonstrate all eight configurations is the maxillary second premolar. [6] Over the past two decade there have been a plethora of published in-vitro studies and case reports depicting a variety of canal configurations. It was seen that gender, race and ethnic origin all play a role in determining the canal morphology and hence should be considered during the preoperative evaluation stage of the root canal therapy.[7]

One of the most important anatomic variations is the –C" configuration of the canal system.C-shaped canals are mostly found in mandibular second molars. Their main anatomical feature is the presence of a fin connecting root canals. A C-shaped canal appears when fusion either on the buccal or lingual aspect of the tooth between distal and mesial roots occurs. This fusion remains irregular, and the two roots stay connected by an interradicular ribbon. The pulp chamber has a single ribbon-shaped orifice with a 180° arc or more which in mandibular molars starts at the mesiolingual line angle and sweeps around the buccal to the end at the distal aspect of the pulp chamber.

The C-shape develops as a result of partial or complete merging of roots, during which the endodontic area also merges to the extent to which the roots have coalesced. However, this process of merging does not always involve all the roots, resulting in the development of a shape resembling a large letter –C", but it can also resemble a small letter "C", which can be found in one or both canals (Jankovi et al, 2000)[7].. Newton et al. [6] illustrated C-shape canal configuration in maxillary first molars. Yang et al. described C-shaped canal in mandibular molars as a ribbon shaped canal that includes the mesiobuccal and distal canals, and sometimes the mesiolingual.[8] . Melton and colleagues [9] discovered this phenomenon in maxillary second molars where the C-shape joins the distobuccal root with the palatal root.

The occurrence of a C-shaped canal and its improper negotiation can lead to failure in endodontic therapy and hence should be gingerly examined. Radiographic appearance of a C-shaped root in mandibular second molars may be diverse, depending on the exact nature and orientation of the root. It may present as a single fused root or as two distinct roots with a communication, the latter of which may not be very obvious at first glance.

Haddad et al. [10] considered them to form a typical radiographic image revealing fusion, root proximity, large distal canal or the blurred image of a third canal in the middle of two roots.

The canal orifice may present with a C-shape, but not always, and when it does, it is no guarantee that it continues spicily as a single canal. Fused roots and C-shaped roots may present with narrow root grooves that predispose to localized periodontal disease, which may, in fact be the first diagnostic indication of such anatomical variance. Moreover it must be kept in mind that very little dentin separates the external surface from the C-shaped canal system, increasing the probability of stripping or lateral perforation during endodontic and restorative procedures.

Branched canal configurations and inter-canal ramifications may render complete debridement of canal systems difficult. The use of sodium hypochlorite, preferably agitated by ultrasonic may help to clean the uninstrumented parts of the root canal system [11]. For obturation of the canal one should select a technique that facilitates the effective sealing of complex root canal systems. Thermoplasticised guttapercha is an appropriate technique, because thermoplasticisation allows better dispersal of the endodontic sealer and guttapercha, and so they are more likely to fill the irregularities of the C-shaped canal system.[12]

As it is known, periapical radiographs are essential in endodontic treatment give only two dimensional information about a three dimensional structure. New techniques are being used to evaluate root canal morphology in three dimentions. cone beam CT (CBCT) is a relative new method that produces three-dimensional (3D) information of the maxillofacial skeleton, including the teeth and their surrounding tissue, . Specific endodontic applications for CBCTare being identified as the use of this technology becomes more common [13]. Cotton et al [14] reported a number of useful applications of CBCT imaging in endodontics. Furthermore, Matherne et al 13.,[15] suggested that CBCT imaging is useful even in identifying the root canal system. The access cavity for teeth with a C-shaped root canal system varies considerably and depends on the pulp morphology of the specific tooth. Initial canal-system recognition occurred after achievement of routine endodontic access and removal of tissue from the pulp chamber[1]. In the above two cases CBCT helped us to confirm the completeness of obturation done which would have been impossible with conventional radiography.

4. Conclusion

It would be quite erroneous to refer to this complex system simply as the ―Rot Canal"-because it actually is a very complex system of finely tuned small tributaries running through the entire length and breadth of the tooth. It is crucial to be aware and admire the various complexities of the spaces we are expected to clean and fill. we must keep in mind the various laid down guidelines and laws to comprehend and perceive the unseen complexities and details to efficiently clean and shape. Three dimensional obturation of the root canal being one of the most important step in the success of root canal treatment, it can be concluded that CBCT can be of great help in confirming the quality of obturations in these complex cases.

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