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Case Report

Endodontic Treatment of Maxillary Second Premolar with S Shaped Root Anatomy Using a Novel Instrumentation Technique

Ankit Arora[1]*, Abhishek Patel[2] and Sonali Kapoor[1]

[1]Professor, Department of Conservative Dentistry and Endodontics, Manubhai Patel Dental College, Vadodara, Gujarat, India

[2]Private Practitioner, Surat, Gujarat, India

***Corresponding Author**: Ankit Arora, Professor, Department of Conservative Dentistry and Endodontics, Manubhai Patel Dental College, Vadodara, Gujarat, India.

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Abstract

Endodontic treatment of "S" shaped root canals is a daunting challenge for any practitioner. Double curvature leads to frequent instrument separation because of cyclic fatigue accumulation. A new technique was used in the case which allowed successful instrumentation of the canals and proved to be more predictable. The length of the S shaped canal was segmented based on position of curvature rather than length of the canal which is followed in conventional crown down approach. Two triangles highlighting the curved parts were identified as critical parts in the path till apex. A systemic approach using conventional k files and controlled memory rotary endodontic files was deployed to deal with this extreme anatomy successfully. The case report underlines the fact that position of the curvature may be considered as an important factor as compared to canal length in dealing with severe S shaped anatomy.

Keywords: *Controlled Memory Wire; Curved Canal; Premolar; S Shaped*

Introduction

Biomechanical preparation of curved root canals demands patience and planning at every step. Degree of curvature and number of curvatures are important factors to be considered during root canal shaping. Curved root canals often suffer from loss of working length, transportation of the apical foramen, ledges, zips, perforations and instrument fracture during shaping [1-3]. Double curvatures or "S" shaped anatomy presents a greater challenge than single curvature as accumulation of fatigue in rotary files is quick in such cases [4]. Even with the advancements in Nickel Titanium rotary (NTR) instruments, biomechanical preparation of S shaped canals remains a challenge [5]. Explained here is a new technique to deal with it which falls in line with the crown down approach but in a more systematic way.

Case Report

A 35 year old female patient reported to the department with the complaint of pain in upper right back tooth since 15 days. Pain was dull, continuous in nature and aggravated on mastication. On examination, deep dentinal caries was seen on 15 and 16. Pulp testing revealed an exaggerated response with lingering pain in both the teeth. Intra-oral periapical (IOPA) radiograph revealed radiolucency encroaching pulpal space in both the teeth (Figure 1). Another significant finding on IOPA was the root anatomy of 15 which had double curvature with fine canals. Hence a diagnosis of irreversible pulpitis was formulated for both the teeth and root canal treatment was advised. The patient went to a private practitioner for root canal treatment where first molar was treated but was referred back for premolar.

Figure 1: *Pre-operative Intra-oral periapical radiograph. Radiolucency encroaching pulp space of second premolar and first molar.*

Anatomy of the tooth was first evaluated in terms of curvature of canal and radius of curvature. Coronal curvature measured 53 with a radius of curvature of 5.5 mm and apical curvature measured 56 with a radius of curvature of 3mm. To deal with these severe curvatures, a new strategy was formulated for glide path preparation. Two strategic triangles (1 and 2) along the root length were identified (Figure 2). Negotiation of root canal within the triangles was planned in a step wise manner. The lengths of canal to be traversed through these triangles were identified as between 7 to 11 mm for triangle 1 and between 14 to 18 mm for triangle 2. The calculations were done using Sopix 2 software (Acteon, La Ciotat cedex, France).

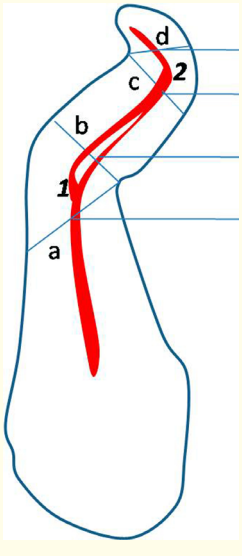

Figure 2: *Line diagram of tooth. Two strategic triangles identified (1 and 2) with relevant sides named as a,b and c,d for both the triangles respectively.*

Following local anaesthesia administration and rubber dam isolation, access cavity was prepared and two orifices were located initially with an interconnecting isthmus (Figure 3). After enlargement of the orifices with rotary Sx file (Dentsply Maillefer, Ballaigues, Switzerland), a #6 file was used initially to negotiate beyond side b of triangle 1 (Figure 2), followed by #8, #10 and #15 number K file. All the files were used in a watch winding manner without any apical pressure. No rotary endodontic files were used at this time to avoid packing of debris in fine canals which could have led to blockage, ledging or transportation. In the next stage, target was set to cross side c of triangle 2 to a point beyond side d (Figure 2). Sequence of k file was unchanged while negotiation. Electronic apex locator was used to keep a track of working length. Once the #15 K file was gliding in a smooth manner till the working length, IOPA was taken to confirm the apical reference point (Figure 4).

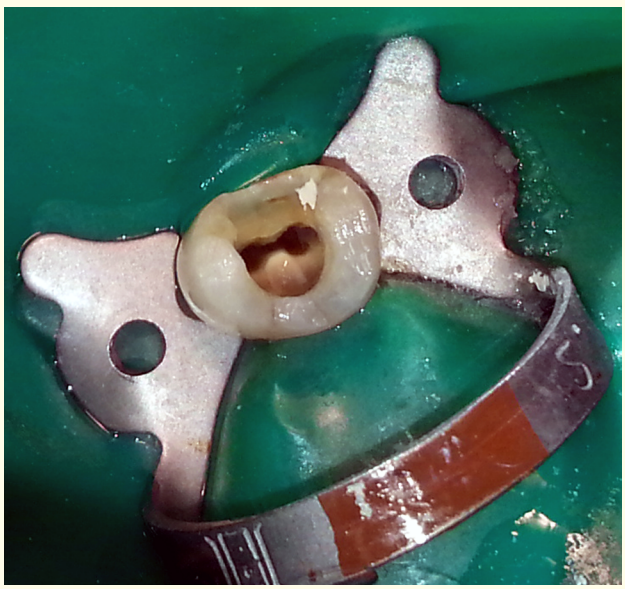

Figure 3: *Intraoral Photograph of tooth with access cavity preparation*

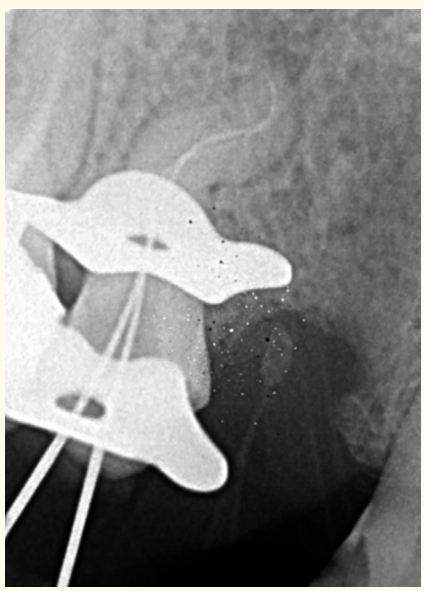

Figure 4: *Working length confirmation on IOPA.*

A new NTR system named Edgeendo (US Endodontics, Johnson City, Tennessee) manufactured of controlled memory wire was used for biomechanical preparation. All the files were used at a low torque and speed of rotation not exceeding 250 rpm. Initially 25 6% file was used without applying any apical pressure beyond the coronal curvature but short of the apical curvature. This was followed by 17 4% file which was allowed to cut till the working length in a step wise manner not more than 1 mm in one attempt. Next, 17 6% file was used 2 mm short of working length, followed by 20 4% and 25 4% files till the working length. 3% Sodium hypochlorite was used as an irrigant intermittently between all the rotary files. #10 k file was used for recapitulation after use of every rotary file. Final irrigation was performed using 17% EDTA followed by 3% Sodium hypochlorite which were activated manually using gutta-percha. Cold lateral compaction technique was used to obturate the canal using Gutta Percha and AH plus sealer (De Trey-Dentsply, Konstanz, Germany) (Figure 5).

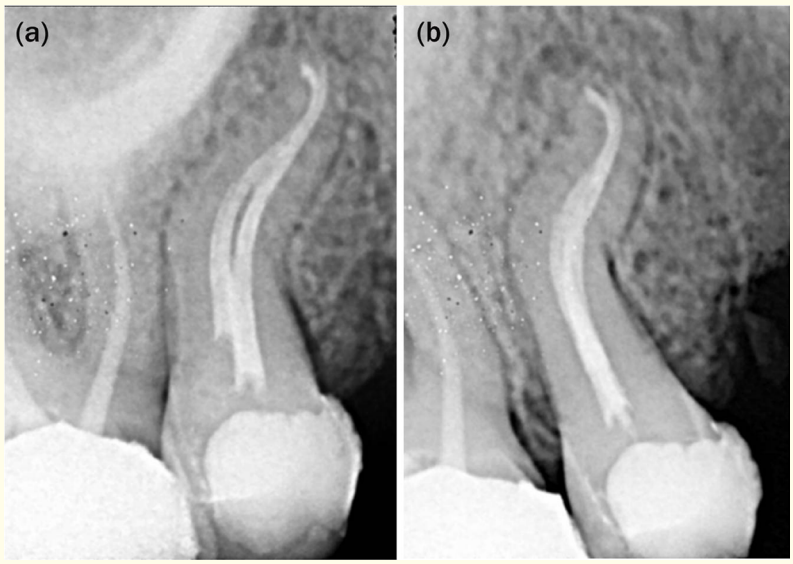

Figure 5: *(a) Post obturation IOPA with Distal angulation, (b) Mesial angulation.*

Discussion

Root canals with severe curvature or small radius bear a negative impact on the instruments [6]. It has been suggested that both angle of curvature and radius of curvature should be evaluated to determine the curvature severity. The complexity of this case is justified as the angles of both curvatures were more than 30 degrees. Occurrence of complications is more likely in curvatures exceeding 30 degrees [7].

To simplify the treatment, it is advisable to divide the procedure into multiple steps and treat the root canal in segments as coronal, middle and apical third. Traditionally, scouter files are used sequentially in coronal, middle and apical thirds of a canal to check for the pilot hole and consequently prepare a smooth glide path [8]. In the present case, the technique was modified in which the extent of file insertion was determined by the root curvature and not by the length of the root. The canal length was divided in segments using triangles because treating the canal as a single length can subject the instrument to stresses which can subsequently lead to separation [5]. As the curvatures are not distributed along the entire length equally and apical third itself may have multiple curvatures, this technique gives an edge over the conventional approach.

Although hand instruments use is time consuming, they were used for glide path preparation as they offer greater tactile sense of the internal anatomy and allow sufficient space for rotary instruments later [9]. Controlled memory wire has proven benefits in preparing S shaped canals because of its high flexibility, no bounce back property and high resistance against fracture [10].

To avoid file fracture, three basic steps of applying minimal apical pressure, low speed of rotation and minimum instrumentation time especially in apical curvature. This helped in minimizing cyclic and torsional fatigue and avoiding file failure.

Conclusion

S shaped curvature cases demand modifications in treatment planning along with patience and perseverance. Curvature centric approach is the key to negotiate such difficult anatomy in a more systematic and predictable way.

Authors Contribution

Dr. Ankit Arora and Dr. Abhishek Patel performed the treatment on the patient. Dr. Ankit prepared the manuscript. Dr. Sonali Kapoor edited the manuscript. All the authors have read and approved the manuscript.

Disclosure Statement

Authors disclose no conflict of interest.

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