Case Report

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Using of Martensitic One Curve File in Re-Treatment of Severe Curved Root Canals

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Abstract

The aim of this case report to use a one curve file in root canal re-treatment of sever and rare curved root by using only one curve file and one visit treatment without using of re-treatments files also obturation has made in one visit with periapical radiograph before and after treatment.

Keywords: Root canal; Mishaps; Martensitic; Curved root canals

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Introduction

A tooth with a straight root and a straight root canal is an exception rather than being normal because most teeth show some curvature of the canal. In addition, most canals have multiple planes of curvature throughout their length and Presence of curvature may pose difficulty in root canal instrumentation [1]. Introduction of very flexible instruments made from nickel titanium alloy having a taper 2-6 times greater than the ISO standardized 0.02 files have revolution in the management of curved canal. They have the ability to pass around curves more readily. They are available as one curve file appears to offer many advantages over traditional 0.02 taper hand instruments. Both instruments can be used in conjunction with or complementary to rotary instruments. Hand Ni-Ti instruments can also be selected instead of rotary instruments in teeth with difficult canal anatomy like severe curvature in apical third and problematic hand-piece access [2].

Nickel-Titanium-based shape memory alloys have been widely used in orthodontics due to their good mechanical properties, biocompatibility [3], ductility, resistance to corrosion [4], lower elastic modulus, and special characteristics such as super-elasticity and shape memory effect [5]. Shape-memory alloys are materials that can remember their original shape, after being elastically or pseudoplastically deformed by increasing their temperature. The memory effect is due to thermoelastic martensitic transformation which can be described as a first-order displaces no diffusional process [6].

Case Report

A 49-year-old female complaining of pain related to lower left side, she had an old bridge which has fallen and she wants to replace it with a new one.

Clinical examination: The lower left third molar tooth number #17 is negative to cold test, positive to percussion; normal finding for periodontal health.

Periapical x-ray: Figure 1 shows short root canal treatment obturation, separated instrument in distal root and highly curved mesial and distal roots.

Diagnosis: Infected tooth due to mishaps in root canal treatment.

Treatment: One visit re-roots canal treatment.

First, access cavity was done using round bur size 3 and M15EZ fissure bur (MAINI, INC). Second, chloroform was used to dissolve the old gutta percha and start negotiating of the canal using ultra sonic tip CPR6 (Kerr Corporation) to remove the separated instrument from distal canal. Third, glide path using EDTA (Meta MD Cleanser, Meta Biomed) until half of the canal by using k-15 then one curve file. Fourth, using K-10 file to measure the working length for all the canals using I PEX 2 Apex Locator (NSK Nakanishi International). Fifth, preparation of the canals to the full working length using one curve file. Sixth, irrigation protocol using 1 ml of NaOCl, 1 ml warm saline and 1 ml EDTA between each step. Seventh, obturation of the canal by vertical compaction technique using (Elements™ Obturation Unit, Kerr Corporation **(Figures 2 and 3).**

Discussion

Before start the treatment, an estimate should be made as to the

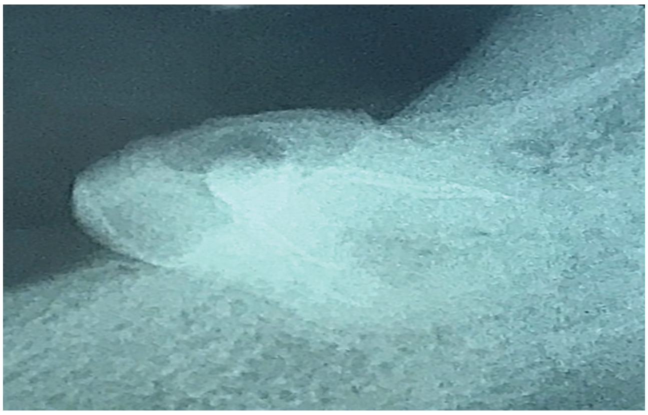

Figure 1 Peri-apical radiograph before treatment show short obturation with curved root.

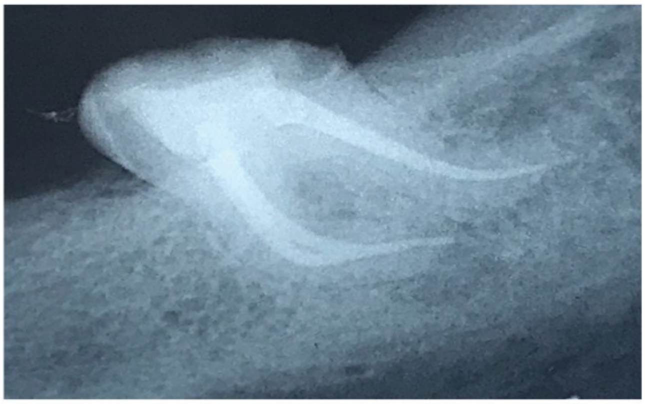

Figure 2 Peri-apical radiograph after treatment.

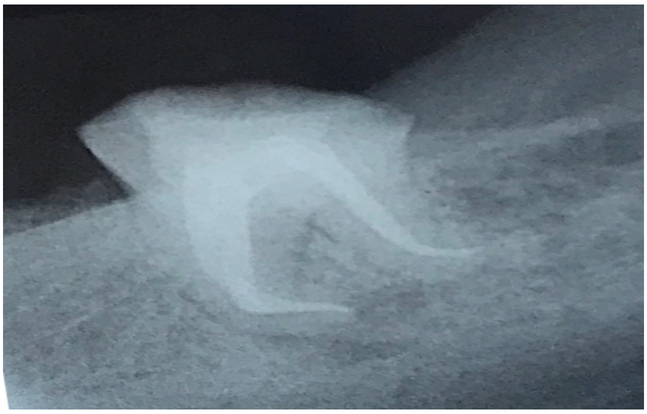

Figure 3 Periapical radiograph with distal shift after treatment.

degree of curvature of canals by visualized on the radiograph. The interior angle is formed by intersection of the straight line from the orifice through coronal portion of the root and another straight line from apex through apical portion of canal [7]. The martensitic transformation is an instantaneous thermoelastic first-order crystalline displaced military process, with diffusionless characteristics in solids, in which atoms move cooperatively, and often by a shear-like mechanism. During transformation, a body-centered cubic parent phase (austenite) shear and gives rise to twinned martensite, which forms the structure of a closely packed hexagonal lattice with an orthorombic or monoclinic arrangement [8]. This change in solid state allows properties as single (one-way), double (two-way) shape memory effect and super-elasticity [9,10].

The shape memory effect allows the alloy to return to its previous shape, recovering from large strains through heating. The formations of directional and strong interatomic bonds are responsible to pull back the displaced structures to their previous positions. All alloys with SME show a change in their lattice structure or atomic arrangement, characterizing a phase change while receiving or releasing thermal energy. This change in Ni-Ti lattice structure is from a high temperature ordered body-centered cubic austenite form (B2 form or parent phase) to a low-temperature orthorombic face-centered cubic shape (B-19 form) or a monoclinic face-centered cubic shape (B-19′ form). Monoclinic phase has no equal sides in the crystal cell and no right angles as it was tilted or squashed. An intermediate trigonal phase between austenite and martensite called R phase can occur as a result of a rhombohedral distortion of the cubic parent phase. Thin plates of R phase nucleate from dislocations (B2 to R), grow and join together while many other plates' forms until the entire region changes into R phase [11]. When the plates shrink and disappear, the phase is reverted to austenite. The reversibility of the process can be induced by heating the alloy above the transformation temperature. The alloy structure returns to its original austenite body-centered cubic parent phase, which is more stable at high-temperature conditions [12].

Besides the thermal energy, stress can also induce the transformation from austenitic to martensitic phase. When sufficient shear stress is applied to an austenitic alloy, martensitic transformation starts in a way to relief the excessive stress applied. While stress is maintained, the material stays in martensitic phase and remains deformed. When shear is removed, the stress remains in a level where the martensite is not stable and the phase is reverted to austenite [13-15].

Conclusion

Pseudoplastic behavior is assigned to situations when the plastic deformation remains recoverable without entering the plastic stage. The amount of plastic deformation that occurs in Ni-Ti alloys is recoverable within certain limits. An irreversible process can be established after excessive stress is maintained, inducing increase of dislocation density which restricts growth of martensite phase and development of stress-induced reoriented martensite resulting in increased transformation hardening.

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