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Multimodality Esthetic Management - A Case Report

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Abstract: ***The successful outcome of root canal therapy is related to the ability to negotiate the canal to its apical terminus, allowing thorough debridement, disinfection, and obturation of the prepared canal space. In situations in which calcific deposits have blocked access to the canal, treatment efforts are often thwarted. This article describes endodontic management of tooth with calcific metamorphosis, associated discolouration and esthetic management of trauma in the permanent dentition with a conservatively designed prosthesis to replace missing tooth.***

Keywords: Calcific metamorphosis, Discolouration, Maryland Bridge

1. Introduction

The management of trauma in the permanent dentition can present a significant challenge to the dental practitioner. Proper medical and dental history, as well as a detailed history of the dental trauma, a thorough clinical examination will assist the dental provider in assessing oro-facial injuries and are instrumental in formulating a proper diagnosis.

A common sequel to dental trauma is pulp canal obliteration; also referred to as calcific metamorphosis (CM).[1] Traumatic injury to the dentition may result in several pulpal reactions. When a tooth has been traumatized, there may be no clinically or radiographically demonstrable effect whatsoever upon the pulp. However, the pulps of traumatized teeth may undergo a variety of changes resulting in pulpal necrosis, internal resorption, or calcific metamorphosis. The presentation of calcific metamorphosis in a previously traumatized tooth confronts the dentist with a difficult decision. If the tooth is otherwise asymptomatic, the practitioner must decide whether or not to intervene by attempting endodontic therapy. The practitioner is faced with the optionfs of either endodontically treating the tooth in order to prevent a possibly untreatable pathological situation in the future or not treating the tooth with the hope that no pathological sequel will arise at a later date.[2] If the tooth with trauma becomes discolored and the patient has esthetic concerns, external bleaching should be considered first. However, since the decrease in translucency and acquisition of a yellowish color may be due to irregular reparative dentin formation, external bleaching of the enamel may not achieve a clinically successful result. Intentional root canal treatment may be performed to facilitate internal bleaching. This may be carried out irrespective of the fact that the pulp is vital or necrotic.[1]

The loss of an anterior tooth is a severe emotional trauma to the patient and if the replacement does not simulate the natural tooth, the effect is multifold. The prosthetic restoration of edentulous span poses a dilemma when the adjacent teeth do not require crowns. It is difficult to justify extensive reduction of the adjacent teeth to support a conventional fixed partial denture. A single tooth implant is an alternative for patients with adequate bone dimensions and who are willing to undergo minor surgical procedure. However, oral implants are not the treatment of choice for many patients and Maryland bridge offers a conservative possible solution especially for missing maxillary anterior teeth.[3] Today techniques and materials are available that provide the clinician a number of options which are both professionally satisfying to the dentist and aesthetically and functionally appropriate for the patient.

This case report highlights the importance of conservative and esthetic management of dental trauma.

2. Case Report

A 24 years-old male patient, residing in Pune reported to the Dept. of Conservative dentistry and Endodontics of Dr. D.Y. Patil Dental Hospital, with the chief complaint of discolouration and missing teeth in upper front region of jaw. Patient gave history of trauma to upper front region of the jaw ten years ago. During which he lost his tooth in upper left front region. Patient was asymptomatic when reported to the department. Medical history and dental history were non contributory. On clinical examination, there was discolouration with 21 and missing with 22.

Figure 1: Pre-op photograph (a) Labial view (b) palatal view

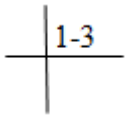
Various investigations were carried out. Pulp vitality test was performed with 11, 21and 23.Tooth no 11 and 23 responded to thermal test and electric pulp test. Whereas,

tooth no 21showed no response to thermal and electric pulp test. Intraoral periapical radiograph with 21 showed complete calcification of pulp chamber and root canal space with minimal or no patency (Figure 2).

Figure 2: IOPA radiograph of 21

- Provisional diagnosis - Non vital 21
- Final diagnosis - calcific matamorphosis with 21.
- Treatment plan

Based on the clinical and radiographic findings, treatment plan was drawn as follows:



- Root canal treatment with 21
- Non –vital bleaching with 21
- Maryland bridge for replacing 22.

Treatment:

Root canal treatment in 21 was initiated under rubber dam. Endodontic explorer was used to scout and locate the root canal orifice. Adequate precautions were taken during access opening using orifice openers and Gates-Glidden burs no 2 and no 3. Smaller sized instruments # 6, 8 and 10 K files were advanced slowly in ¼ turn clockwise and anticlockwise in the root canal until the desired length was achieved along with 17 % EDTA gel; 3% NaOCl and liquid EDTA were used as irrigants during instrumentation. Working length radiograph was taken (fig. 3a). Canal was enlarged till #30 size using 2% taper instruments (fig. 3b). Intracanal medicament of aqueous CaOH (Rc Cal) was given for one week. Obturation was completed using AH Plus sealer and lateral condensation method (Figure 3c).

7 days after obturation non vital bleaching was done in 21 using 35% hydrogen peroxide gel. (Opalesence Endo).

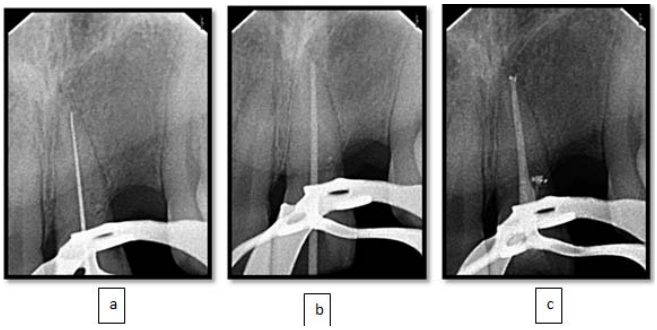


Figure 3: (a) Working length with # 15 k file, **(b)** Master cone with 2% # 30 GP cone, **(c)** Obturation completed with lateral condensation technique

After the completion of root canal treatment, the bleaching procedure was done following the standard protocol of walking bleach method by Grossman. Initial tooth shade was taken, and then root filling was reduced 1–2mm below the CEJ using GG drills. This was determined by using a periodontal probe placed in the pulp cavity, while reproducing the corresponding external probing to the CEJ. Using resin reinforced GIC (Vitribond, 3m) as the gingival barrier and 35% hydrogen peroxide. Interim restorative material was placed to close access cavity. The procedure was done as per the need for change in colour. In this case only one application of bleaching agent was sufficient.

Following bleaching, replacement of missing teeth was planned using Maryland bridge prosthetic conservative design. Tooth preparation for both 21 and 23 was done using standard technique with reduction of enamel on palatal surface having single path of insertion. Light chamfer finish lines were made 1-2 mm supragingivally, (fig.4) sufficient lingual surface clearance of 0.5 to 1 mm and interproximal extension with retentive grooves was given. Impression was made in polyether impression material and sent to the laboratory. Metal try-in was done to check the fit and retention of casting. And finally the bridge was cemented on the following appointment with resin cement (Rely X ARC) (Figure 5)

Figure 4: Tooth preparation for Maryland Bridge

Figure 5: Final prosthesis with Maryland bridge (a) facial view (b) palatal view

3. Discussion

Traumatic dental injuries are for the most part unanticipated events that, if not managed appropriately, can have serious consequences on the physical and psychological health of the patient. The process of calcific metamorphosis is a response to traumatic injury that is most commonly seen in anterior teeth. Calcific Metamorphosis is defined as a pulpal response to trauma that is characterized by rapid deposition of hard tissue within the root canal space.[1] The clinical picture of Calcific Metamorphosis has been described as a tooth that is darker in hue than the adjacent teeth, and exhibits a dark yellow color because of a decrease in translucency from a greater thickness of dentin under the enamel .[4] In certain traumatic injuries, a temporary disruption of blood supply occurs followed by destruction of odontoblasts. These are replaced by undifferentiated mesenchymal cells that rapidly form reparative dentin. As result the translucency of crowns of such teeth gradually decreases giving rise to yellowish or yellow brown discolouration. This has been postulated to be a result of uncontrollable mineralization in which the normal self-limiting enzyme, the pyrophosphatase, fails to operate (Hithersay 1975). A reduced capillary permeability following the increased number of calcium ions could reduce serum flow within the dental pulp resulting in a low concentration of inhibitory pyrophosphatse ions. Moreover, a loss of the parasympathetic inhibition could cause a reduction in pulpal blood supply that could result in cellular respiratory depression, leading to pathological calcification of the pulp and eventually, obliteration of the root canal (Anreasen 1989).[5] An examination of 881 midshipmen entering the United States Naval Academy revealed that 34 of the patients had a total of 41 anterior teeth exhibiting partial or total obliteration of the pulpal spaces, a patient incidence of 3.86%.[6]

Does a tooth with calcific metamorphosis need a root canal?

In 1965, Patterson and Mitchell [4] felt that a tooth that had signs of calcific metamorphosis due to trauma should be regarded as a potential focus for infection and that root canal therapy should be initiated. However, further research and clinical observation provided the foundation for current guidelines. The Naval Academy study [6] found that over a four year period only 3/41 (7.3%) of teeth with

Calcific Metamorphosis developed pulpal necrosis, and as a result the only definitive criterion for endodontic treatment was the appearance of a periapical radiolucency. Jacobsen and Kerekes[7] conducted a study of 122 traumatized teeth in which partial canal obliteration was identified in 36% of the cases and total canal obliteration in 64%. Only 13% eventually developed pulpal necrosis. Smith [8] performed a literature review and found that teeth with calcific metamorphosis have a low incidence of development of periapical pathosis (0-16%) and recommended delaying treatment until symptoms or radiographic changes develop. The development of Calcific Metamorphosis following trauma does not justify prophylactic root canal therapy. But complete radiographic obliteration of the root canal space does not necessarily mean the absence of the pulp or canal space; in the majority of the cases, a pulp canal space with pulpal tissue is present.[1]

In this case, the access opening was already initiated and the vitality test confirmed that the tooth was non-vital, hence to prevent a possibly untreatable pathological condition in future root canal treatment was attempted. The patient was warned of the risk involved, especially the risk of perforation while gaining access to the root canal and possibility of instrument separation.

Success in root canal therapy is based on proper debridement, disinfection and obturation of root canal system. In this case liquid EDTA was used as chelating agent. Chelator preparations have been advocated frequently as adjuncts for root canal preparation, especially in narrow and calcified root canals. However, the degree to which these agents actually facilitate negotiation and preparation of such canals is unknown. This is not only because of the difficulty in providing a sufficient amount of chelating agent to this part of the root canal, but also reflects the differences in structure between the middle, coronal and apical dentin. Apical dentin is more frequently sclerosed, and is more mineralized. The authors recommend liquid EDTA solution be introduced into the pulp chamber (pipette, cotton pellet) to identify the entrance to calcified canals.[9]However, W.C.NGeow etal in 1998 suggested that chelating agent should only be used to soften the canal wall after the canal has been located. Its use in an attempt to locate the canal orifice is improper.[5]

After access cavity was made, the canal was located using DG-16 endodontic explorer. The canal was totally debrided and prepared using K files and 3% NaOCl irrigation. NaOCl enhances the dissolution of organic debris, lubricates the canal, and keeps the dentin chips and pieces of calcified material in solution. Smaller size instruments # 6, 8 & 10 with copious irrigation at all times with 2.5 % to 5.25% NaOCl. Always clean the instrument on withdrawal and inspect before reinserting into the canal again. When a fine instrument has reached the approximate canal length, do not remove it; rather obtain a radiograph to ascertain the position of the file.

Following aids can also be used in dealing with calcified canals:

- Magnification enables more accurate and thus conservative, preparation through dentin.
- Troughing grooves with Ultrasonic tips e.g. Satellac, Dentsply
- C pilot files by VDW
- Use of intermediate files
- Staining with 1% methylene blue dye, champagne bubble test.

Bleaching of intact endodontically treated teeth that present with chromatic alterations is a conservative alternative to a more invasive esthetic treatment such as placement of crowns or veneers.

Non-vital internal bleaching was done using 35% hydrogen peroxide using “walking bleach” technique. The bleaching agents that are most commonly used for whitening of root-filled teeth are hydrogen peroxide, carbamide peroxide, and sodium perborate. Hydrogen peroxide is the active ingredient in currently used tooth bleaching materials. It might be applied directly or can be produced by a chemical reaction from carbamide peroxide or sodium perborate. Hydrogen peroxide is used in dentistry as a whitening material at different concentrations from 5%–35%. Because of its low molecular weight, this substance can penetrate dentin and can release oxygen that breaks the double bonds of the organic and inorganic compounds inside the dentinal tubules. Numerous studies that have reported the successful use of the walking bleach technique for correction of severely discolored teeth. Freccia et al proved that the walking bleach technique with a mixture of 30% hydrogen peroxide and sodium perborate was as effective as the thermocatalytic technique.[10]

A root filling does not adequately prevent diffusion of bleaching agents from the pulpal chamber to the apical foramen. Hansen- Bayless and Davis indicated that a base is required to prevent radicular penetration of bleaching agents.[10] In this study resin modified GIC (RMGIC) was used as a barrier. A cervical barrier with RMGIC might reduce apical leakage of the bleaching agents. Karen et al in 2013 concluded that RMIGIC barrier provided better sealing ability than the zinc phosphate cervical barrier.[11] Other features included dental adherence, resistant to dissolution by bleaching agent, tooth coloured and does not stain dental structure.

Replacement of missing teeth is another dilemma for any clinician. Longitivity of prosthesis with the most conservative design is a challenging issue. The Maryland Bridge is a conservative bridge with the advantage of minimal tooth preparation reduction on the palatal or lingual surface of the abutment teeth.[12] Tooth reduction may be limited to enamel without exposing dentin. This helps to minimize the risk of experiencing tooth sensitivity following the procedure. This procedure is particularly indicated in young patients who have missing lateral incisors with no occlusal interference. Maryland Bridges are financially viable options for many restorative cases

when there is assurance of complete, long-term bonding, and patient with favourable occlusion.[12] This prosthesis incorporates a metal substrate to fabricate an abutment, and its advantages include minimal tooth preparation when compared to conventional PFM Bridge and its cost effectiveness.[13]

The Maryland Bridge has undergone many alterations in design since its introduction in 1980. Retention has been improved with a more retentive framework design, the addition of grooves, labial wrap, and the concept of maximum coverage of the enamel. Improvements in material will continue. If the dentist maintains meticulous attention to detail and proper patient selection, the Maryland Bridge will continue to be not only a conservative restoration alternative, but a primary choice.[6]

Advantages

- Noninvasive with lingual and proximal tooth preparation
- Conservative design
- Tissue tolerant due to supragingival margin
- Reduce cost with less chair side time

Disadvantages

- Demanding precise technique including tooth preparation
- Heavy dependence on laboratory work
- Usually restricted to one single pontic replacement
- Occlusion needs to be favorable with no interference with jaw movement.

4. Conclusion

Conservative aesthetic rehabilitation appears much more predictable today especially due to advancements in diagnostic aids, instrumentation techniques and design strategies for replacement of lost tooth structure. Careful case selection, judicious design planning, precise preparation and meticulous step by step implementation of treatment regime can all ensure the long term success.

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