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A holistic approach to traumatised anterior teeth: A case report

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ABSTRACT

As oral cavity stands the sixth most afflicted area of human body, it frequently encounters instances of traumatic dental injuries. While severe injuries like avulsions are prompt at seeking dental attention, less severe injuries like enamel dentin fractures are often reported after substantial delay. Over time, these cases may present with myriad signs and symptoms including sudden pain, swelling, discolouration and immature root development, requiring comprehensive management. This case report discusses one such instance of a traumatic dental injury that presented years after the initial trauma with multiple findings. Each problem was addressed sequentially which transformed the situation holistically.

Keywords: direct composite restoration; intracoronal bleaching; mineral trioxide aggregate apexification; root canal therapy; traumatic dental injury.

INTRODUCTION

Traumatic dental injuries (TDIs) are prevalent concern globally, with a prevalence rate varying considerably between 4% to 58% in epidemiological studies.[1] A global systematic analysis by Petti et al. reports that around 900 million people worldwide aged 7-65 years have damaged permanent teeth.[2] The most common type of TDIs in Nepal's context remains crown fractures, particularly affecting the maxillary incisors.[3,4] The associated signs and symptoms with these injuries vary depending on the time of their clinical presentation, necessitating treatment accordingly. An untreated and unsightly fracture in the critical anterior region can significantly impact an individual's psychological well-being.

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CASE REPORT

A 24-year-old male presented to the Conservative Dentistry and Endodontics Unit, Department of Dental Surgery, Bir Hospital, Mahabouddha, Kathmandu with a chief complaint of pain in the upper front teeth region for one week. The pain was gradual in onset, moderate in nature, continuous, and throbbing type which aggravated on lying down. Patient gave the history of trauma in the upper front teeth region 16 years back while participating in sports. The incident resulted in fracture of an upper front tooth for which he did not seek any treatment at that time. Five years back, he experienced pain in the same region and root canal treatment was done in an upper front tooth. His medical history was found non-contributory and he had no significant personal habits.

Extraoral examination revealed no significant findings. Intraoral clinical examination revealed discolouration in teeth #11, #21, #22 (according to the two-digit teeth numbering system); fracture of mesioincisal edge of

tooth #11; restoration on the palatal aspect of tooth #21; and mild swelling of labial marginal gingiva in teeth #11 and #21 with no vestibular obliteration, sinus tract or any discharge (Figure 1).

On palpation, vestibular tenderness was noted on teeth #11, #12, and #21. On percussion, the teeth #11, #12, and #21 were tender. Probing depths and mobility were within normal physiological limits.

Intraoral periapical (IOPA) radiographs revealed a well-defined periapical radiolucency in teeth #11, #12; immature root apices in teeth #11, #21, and #22; inadequately obturated tooth #21 and widened periodontal ligament space in teeth #21, #22 (Figures 2A, 2B).

Electric and thermal testings failed to elicit response in all the mentioned teeth. Based on these clinical and radiological findings, diagnoses were established as uncomplicated crown fracture with pulp necrosis and symptomatic apical periodontitis for tooth #11, pulp necrosis with symptomatic apical periodontitis for tooth #12, previously treated tooth with symptomatic apical periodontitis for tooth #21, and pulp necrosis with asymptomatic apical periodontitis for tooth#22. Accordingly, treatment plan was formulated as root canal treatment with mineral trioxide aggregate (MTA) apexification, followed by intracoronal bleaching and composite restoration for tooth #11, root canal treatment for tooth #12, root canal retreatment with MTA apexification, followed by intracoronal bleaching for tooth #21, and root canal treatment with MTA apexification, followed by intracoronal bleaching for tooth #22.

The treatment plan was discussed with the patient and consent was obtained. Beginning with the procedure, under rubber dam isolation, access cavities were prepared for teeth #11, #12, and #22. For tooth #21, coronal disassembly was performed, followed by gutta-percha removal using H-files. Working lengths were determined radiographically and with apex locator (E-Pex Pro, Eightieth) (Figures 3A, 3B).

Chemomechanical preparation was done for teeth #11, #21 and #22 with ISO K-files (Mani) using circumferential filing motion till size 80. For tooth #12, apical preparation was done till size 45 and step-back preparation was done till size 70. Irrigation was done between each change of instrument with 5 ml of 3% sodium hypochlorite (NaOCl) (Neelkanth) by placing the needle 2 mm short of working length. Final irrigation was performed with 5 ml of 17% ethylenediaminetetraacetic acid (EDTA) (Prevest DenPro) and 10 ml of 3% NaOCl. Manual dynamic agitation of the irrigants was performed using gutta percha points. Excess fluids were removed with absorbent paper points and calcium hydroxide dressing was placed for one week.

In the following week, the patient was asymptomatic. Teeth were again accessed under rubber dam isolation, calcium hydroxide was removed by irrigation with copious amount of normal saline and 3% NaOCl. Excess fluids were removed and MTA apexification was carried out for teeth #11, #21, and #22. Just before placing MTA, an apical matrix of resorbable collagen was gently placed on working length with the help of preselected hand pluggers. Then, MTA (Prevest DenPro) was mixed according to the manufacturer's instructions and using MTA carrier and hand pluggers, the mix was gently condensed against the matrix to form approximately 4 mm of apical plug. It was confirmed radiographically (Figures 4A, 4B). Then a moist cotton pellet and temporary filling material was placed.

Next day, cotton pellet was removed and obturation was performed using thermoplasticised gutta percha obturation technique for teeth #11, #21 and #22 using a thermoplastic obturation device (Meta Biomed EQ-V). For tooth #12, lateral condensation technique was used. Coronal restoration was finished using glass ionomer cement and post-treatment radiographs were taken to evaluate the degree and quality of obturation (Figure 5A, 5B). The patient was recalled after 3 months. At the follow-up visit, clinical examination revealed normal function without symptoms. Radiograph showed healing periapical lesion (Figure 6).

After the confirmation of the success of the apexification procedure, the next step was to treat the discolouration. Intracoronal bleaching was planned for teeth #11, #21 and #22, however, consent was obtained only for teeth #11, #21. After oral prophylaxis, baseline shade was determined using colour tabs on the Vita Classical shade guide (Figure 7). Gutta percha was removed up to approx. 1-2 mm beyond the cementoenamel junction. A barrier of 1-2 mm of glass ionomer cement was placed over the gutta percha. Bleaching gel containing 35% hydrogen peroxide (Opalescence Endo, Ultradent) was placed into opened pulp chamber and temporary restoration was done. Patient was recalled after one week. At the following week, desired shade was already achieved in tooth #11 and improvement in shade was noted in tooth #21 (Figures 8A, 8B). So, bleaching gel was replaced in tooth #21 for further 1 week. Noticing the improvement in shades of teeth #11 and #21, consent

was also obtained for the bleaching of tooth #22 as advised earlier. Therefore, the procedure was similarly performed for the tooth #22. At the end of second session of bleaching, desired shade was achieved in the other two teeth #21 and #22 (Figure 9).

Upon completion of bleaching, the pulp chambers were rinsed, dried and a calcium hydroxide paste was applied to the cavity dentin walls. The final restoration was performed after two weeks using composite (Te Econom Plus, Ivoclar).

Following the bleaching procedure, the fractured edge of tooth #21 was restored using direct composite resin under rubber dam isolation (Figure 10). The final clinical presentation after composite restoration (Figure 11).

On a 12-month follow-up visit, signs of healing and reduction of the large apical radiolucency was well appreciated in the radiographs (Figures 12A, 12B). Also, the clinical presentation at the follow-up was found satisfactory (Figure 13).

Figure 1: Initial clinical photograph

Figure 2A, 2B: Preoperative intraoral periapical radiographs

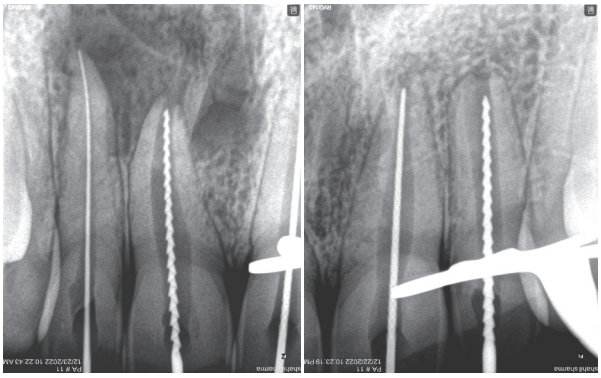

Figure 3A, 3B: Working length radiographs

Figure 4A, 4B: Mineral trioxide aggregate (MTA) apical plugs approximately 4 mm

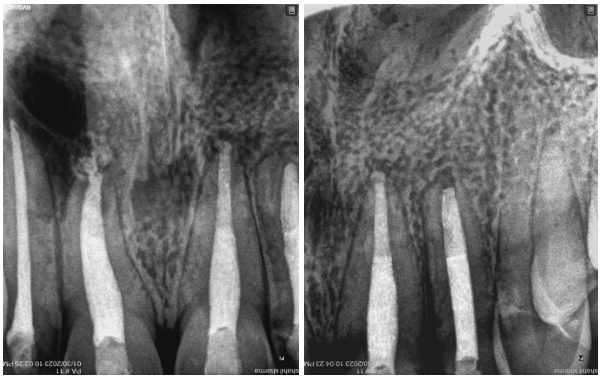

Figure 5A, 5B: Post-obturation radiographs

Figure 6: Follow-up radiograph at three months

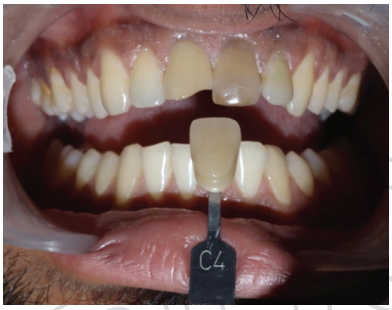

Figure 7: Baseline shade determination using VITA Classical shade guide

Figure 8A, 8B: Shade after first session of bleaching. Desired shade achieved in tooth #11

Figure 9: Final clinical photograph after bleaching

Figure 10: Clinical photograph after composite restoration

Figure 11: Clinical photograph after composite restoration

Figure 12A, 12B: One year follow-up radiographs

Figure 13: Clinical photographs at one year follow-up

DISCUSSION

Traumatic dental injuries are very common in the world population with several studies reported in the international literature. They represent around 5% of all health injuries.[2] The severity of these injuries can range from minor chips or cracks in the enamel to the total avulsion of teeth or they may occur as combination injuries, where both fractures and luxations occur simultaneously in the same tooth. In the context of Nepal, uncomplicated and complicated crown fractures remain the most common forms of these injuries to the permanent dentition. They mostly affect the upper incisors which are exposed in the dental arch and are frequent in children between eight years to 10 years of age, which corresponds to the time of root development.[3]

While the severe forms of injuries like complicated crown fractures (enamel, dentin, and pulp) and avulsion tend to seek immediate dental attention, less severe injuries like uncomplicated crown fractures (enamel and dentin) usually remain neglected for long due to the lack of any major symptoms at the time of injury, as in this case presented. In such cases, the penetration of bacteria through the exposed dentinal tubules gradually lead to pulpal necrosis and subsequent arrest of root formation along with the development of periapical lesion. Discolouration may result from the breakdown products of haemoglobin and other haematin molecules, which may permeate into the dentine.[5] On the other hand, patients living with a fractured and discoloured upper front tooth for long may have psychological and social effects, lacking confidence to smile.

When these cases present due to acute exacerbations of long standing periapical infections, they often require a comprehensive and holistic approach to take care of the pulpal and periapical pathology, the open apex, the discolouration and ultimately the confidence of the patient as in this case. Conventional root canal therapy following standard irrigation protocol eliminates the necrotic tissues, involved microbiome, their byproducts and virulence features from the canal space. Irrigation, however, becomes challenging in cases of open apices due to the risk of extrusion beyond the apex. The NaOCl (0.5%–6%), 17% EDTA and 2% chlorhexidine (in infected teeth) are commonly used irrigants, but active irrigation is discouraged in such cases. Side-vented needles (e.g., Max-i-Probe) and techniques like negative apical pressure (EndoVac) reduce extrusion risk, though they may be less effective in penetrating lateral anatomies and dentinal tubules. Therefore, high-performance activation methods, such as passive ultrasonic irrigation (PUI), sonic activation (EDDY), laser activation (Er:YAG, Er;Cr;YSGG, diode) and manual dynamic agitation becomes critical for biofilm removal, especially in cases with periapical lesions. Recently, the collagen apical barrier (CAB) technique, has been developed, in which a small part of collagen is placed beyond the apex, allowing safe irrigant activation without the risk of extrusion. After activation, the collagen can either be left in place or removed using a modified suction tip, trimmed at the first millimetres for optimal suction.[6]

A further difficulty in immature teeth arises due to the absence of an apical stop to limit the obturation. Over the years, a variety of materials have been employed for apexification in such cases. Traditionally, calcium hydroxide was the material of choice due to its ability to stimulate hard tissue formation; however, its prolonged treatment duration and associated risk of tooth fracture limited its use. The MTA, ever since its introduction, largely replaced calcium hydroxide due to its superior biocompatibility, excellent sealing properties, and ability to promote faster apical barrier formation. Biodentine, a more recent bioceramic material, offers similar advantages to MTA, with the added benefits of improved handling and a shorter setting time. Other bioactive materials, such as EndoSequence Root Repair Material (ERRM) and Bioaggregate, are also used because of their enhanced bioactivity and sealing capabilities.[7] The choice of material often depends on factors such as clinical situation, ease of use, treatment duration and cost-effectiveness. In this case, MTA was used. Because of its ability to facilitate periradicular healing by inducing hard-tissue formation, apexification with MTA has proven to be a successful and predictable procedure. Numerous case series and prospective studies involving MTA plugs have consistently demonstrated high success rates, highlighting their effectiveness in clinical applications. Ree et al. reported a 96% success rate in 5 to 15 years of follow-up while Santos et al. have reported a survival rate of 93.8% within a follow-up of five years to 22 years.[8,9]

The thermoplasticised gutta-percha obturation method is primarily used in teeth with open apices with thin dentinal walls since it can be placed without applying any compaction forces in contrast to lateral condensation method. Also, the thermoplasticised gutta-percha flows very well into the canal spaces and obturate the canal system effectively. Thus, this obturation technique was preferred in this case following MTA obturation.

A range of techniques has been introduced for managing discoloured non-vital teeth, such as intracoronal

bleaching, restorative procedures, and prosthetic options. In this case, intracoronal bleaching was preferred because of its simplicity, reliability, cost-effectiveness, minimally invasive nature and higher reported success rates. Amato A et al study has reported 85% success rate for intracoronal bleaching after 25 years follow up.[9] Composite restoration was delayed for a period of two weeks following bleaching to mitigate any potential adverse effects of the bleaching agents on bonding.

CONCLUSION

Cases of trauma which report years after the incident may present with multiple findings. Such cases should be managed sequentially focussing on individual problem at a time, ultimately managing the overall problem, thereby restoring the smile and confidence of the patient.

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