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Vital Pulpotomy of a Mature Tooth Using PRF- An Alternate to Traditional RCT

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Introduction

Dental pulp plays a major role to maintain the function and integrity of the tooth organ. Exposure of the dental pulp, through a carious lesion, accidentally during routine cavity preparation, or as a result of tooth fracture, is a clinical reality that requires optimal treatment [1] . The overall response of the tooth to injury, such as dental caries, represents the complex interplay between injury, defense, and regenerative processes. While each of these is sometimes considered in isolation, it is important to know that the interaction and relative balance amongst these measures will be the main factor of tissue vitality and tooth survival [2] . Therapeutics of dental pulp diseases contain vital pulp therapies like direct and indirect pulp capping, pulpotomy in the first stages or pulpectomy if the lesion presents in its advanced stages. Conservation of pulpal vitality is of supreme importance as the vital functioning pulp is gifted of starting numerous important functions like the formation of dentin, providing nutritive support to the tooth, supporting a defensive function, and possessing a unique reparative capacity [3] .

In young permanent teeth, a pulpotomy is characteristically undertaken to stimulate apexogenesis. The objective is to endorse root development and apical closure. Once root end development and apical closure are completed, the root canal treatment will be finished [4]. However, it has been proved that mere pulp exposure does not cause pulpitis in the absence of bacteria [5] . Recent studies have proposed that as long as a hermetic seal is ensured, root canal treatment is not necessary following pulpotomy[6].

Plentiful case series have recommended pulpotomy as a possible treatment for pulp exposures with pulpitis; the foundation being the healing potential of the remaining radicular tissue and the biocompatibility of pulpotomy agents, especially mineral trioxide aggregate [7] . Therefore, it is important to develop biocompatible treatments focused at maintaining pulp vitality and increasing tooth

longevity. To escalation the success rate, a critical essential exists to develop novel biologically-based therapeutics that reduce pulpal inflammation and endorse the creation of dentine-pulp tissues [2] .

Platelet-rich fibrin is a second-generation platelet concentrate introduced by Choukroun (2008) et al. It is strictly autologous and assistances to release the growth factors essential for the regeneration of dentin pulp complex thereby accelerating the healing process [2, 8] .

Case Report

A 9 years old male patient reported to the department with pain in the right upper back tooth region. Clinical examination revealed carious involvement & irreversible pulpitis related to the maxillary right molar tooth. IOPA-R was advised which revealed pulpal involvement of the tooth without any periapical rarefaction. The patient was selected for tissue engineering and written consent was taken from his parent. Lignocaine with 1:80,000 Adrenaline was given and the tooth was isolated under rubber dam. Caries was removed using a large round bur at slow speed with plenty of water. Another sterilized round bur was used to remove the 2/3rd infected coronal pulp from the pulp chamber. Remaining healthy radicular pulp was flushed with normal saline & a moist cotton pellet was placed for 2-3 min. to achieve hemostasis. When the cotton pellet was removed, bleeding was stopped & clean healthy pulp tissue was visible without any blood clot.

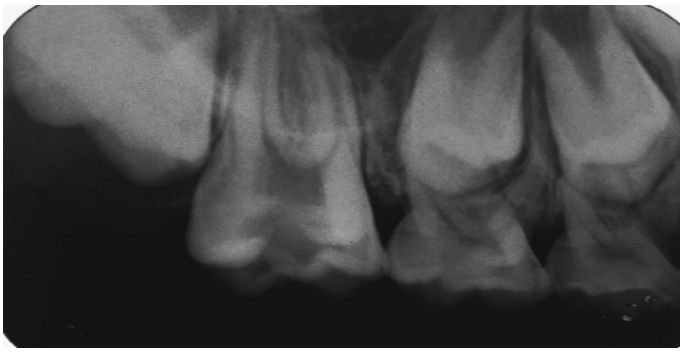

Figure 1: Pre-operative Radiograph

Figure 2: PRF,

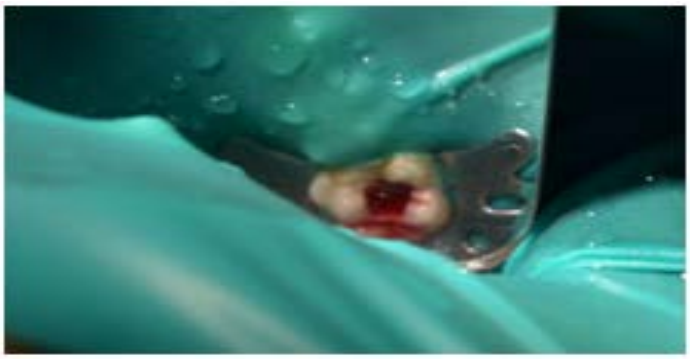

Figure 3: Access opened

Figure 4: MTA Placed over PRF

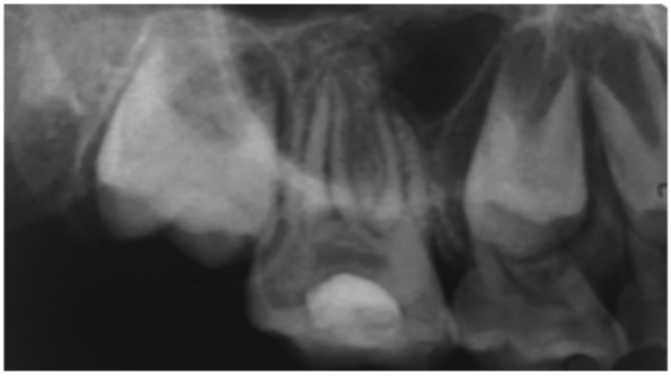

Figure 5: 6 months follows up radiograph

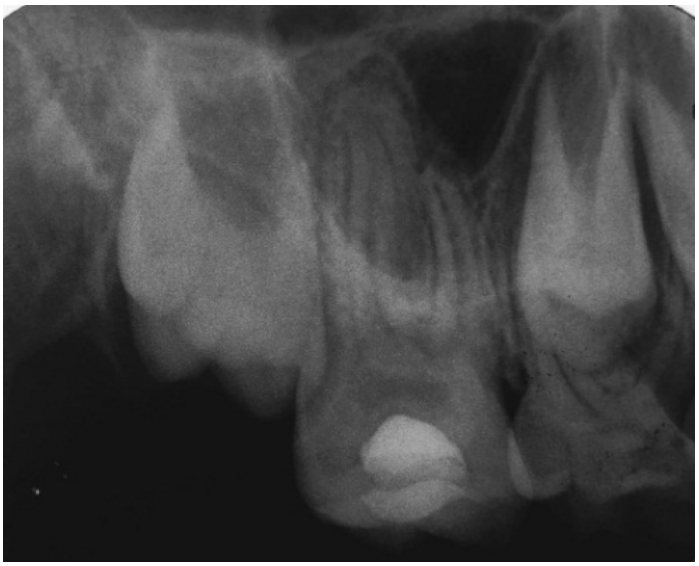

Figure 6: 12 month follow-up Radiograph

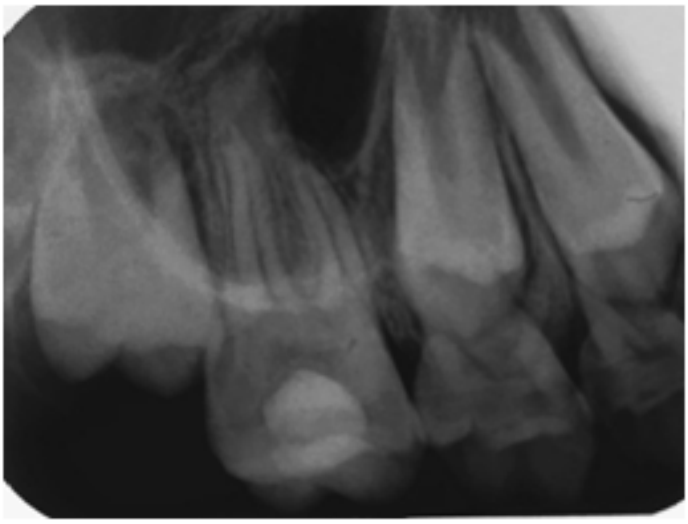

Figure 7: 15 month follow-up Radiograph

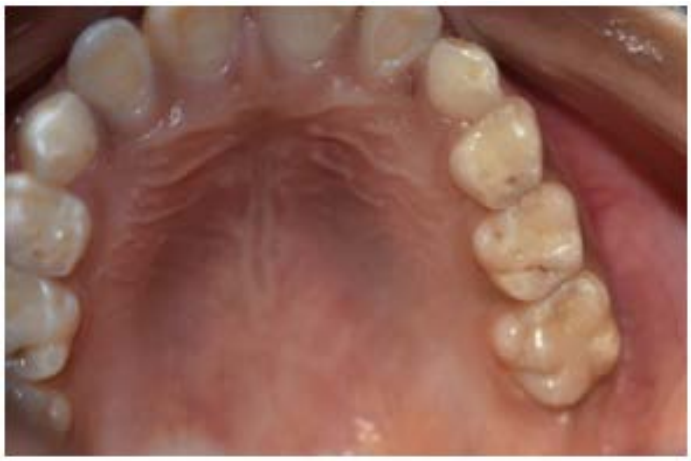

Figure 8: 12 month follow up clinical photograph

After getting written consent from the patient's parent, 10 ml. of whole blood was withdrawn from the patient's body & collected into a sterilized test tube. It was then centrifuged at 3000 rpm for 10 min. Three distinguishable layers were formed in the test tube.

A Dispovan 5 ml. a syringe was used to collect the clear superficial layer from the test tube for further use. The PRF was taken out then from the test tube & cut from the precipitated R.B.C. layer by sterilized scissors. The PRF was then collected over a sterilized surgical gauze piece & wrapped in it without squeezing for 1 min. to form a membrane.

PRF plug was prepared from the membrane which was then put over the healthy pulp tissue after flushing with the clear superficial layer of the PRF making test tube. 2 mm thickness of MTA (Angelus) was put over the PRF & a temporary filling material was placed over it & the patient was discharged for 24 hours.

After 24 hours, patient reported back with no symptom of pain or inflammation. The temporary restoration was removed & GIC was placed over set MTA. Checkup was done in 1, 3, 6, 12, 15 months interval & radiographs showed no change periapical or intrapulpal. No pulpal space closure like pulp obliteration was seen& the patient was symptom-free. On 3 months recall light cure restoration was done for a functional requirement.

Discussion

In the majority of the conditions, the primary cause of pulpal and periapical diseases is leading to bacterial infection and the most common route of entry is through the carious lesion. The most steadfast way of releasing the acute pain of a patient with irreversible pulpitis is by carrying out emergency treatments like pulpotomy or pulpectomy [9, 10]. The pulpotomy is a universally accepted treatment for teeth with incompletely formed roots involving pulpal exposure [11]. When there are no limits on

the time and the cost factor, root canal therapy can be a perfect choice of treatment in numerous clinical situations with a success rate of ±95% as demonstrated in numerous literature studies [10]. However apart from some very difficult cases, it is relatively more time-consuming and expensive and often the outcome of the treatment provided by the general dentist is poor. Also, patients from the lower economic part opt for extraction of the involved tooth rather than the root canal therapy due to the high cost of the root canal therapy.

Thus, other measures such as pulpotomies might serve as feasible, less aggressive, budding treatment choices and could help avoid unnecessary dental extractions or dental negligence in some situations [7].

The technique of pulpotomies in mature teeth with developed apices has been examined to a much lesser degree and related disagreements still exist in the literature. However, a systematic review conducted by Aguilar and Linsuwanont has established the success rate of vital pulp therapies in vital permanent teeth with closed apices, presentation a relatively high success rate of 99.4% for partial pulpotomy and 99.3% for full pulpotomy[12]. Eghbal et al. have estimated the histological success of pulpotomy in permanent molars of patients in the age extending from 16 to 28 years and the histological observations discovered a complete dentinal bridge with radicular pulp remaining vital and free of inflammation in all the samples[13].

Numerous studies have testified the cytotoxicity of freshly mixed calcium silicate-based synthetic materials because of their high initial pH. Hence in the present case series, the radicular pulp tissue is covered with a biologically based material like PRF to avoid any detrimental effects on the pulp as a result of the synthetic cement materials[2].

Bezgin et al. targeted to clinically and radiographically assess the efficacy of platelet-rich plasma (PRP), 1st generation platelet concentrates, when used as a scaffold in regenerative endodontic treatment and match it with that of a conventional blood clot (BC) scaffold. However, they concluded that the treatment outcomes did not differ significantly between both groups, though, the PRP group achieved better and presented faster healing[14].

PRF is an autologous foundation of the growth factors such as platelet-derived growth factor (PDGF), transforming growth factor 1 (TGF β1) and insulin-like growth factor (IGF) [15]. It is a concentrate of platelets and cytokines extensively employed to quicken the healing of the soft tissue and hard tissue lesions and is considered to be an ideal substance to repair and regenerate the pulp-dentin complex[16]. One of the most suitable autologous and biological scaffolds is PRF. The benefits of PRF over the platelet-rich plasma (PRP) are ease of preparation/application, negligible expenditure, and absence of biochemical alteration (no bovine thrombin or anticoagulant is mandatory) [2].

Numerous biomaterials have been announced with the aim of upkeep the vitality of the pulp. The prognosis of the treatment depended upon the biocompatibility and the ability of the material to provide a good biological seal. However, one has to bear in mind that the ability of the pulp to respond to the injury also plays a significant role1[17, 18].

In current years, MTA has been familiarized with pulpotomy in primary molars [19] and has demonstrated very good biocompatibility [20], outstanding sealing ability [21] and prompt of healing in the pulpal tissue (Asgary et al. 2008)[20].

In the 1st report of MTA pulpotomy of mature human permanent teeth, a case sequence of 14 mature human permanent molar teeth with so-called irreversible pulpitis, a histological examination discovered complete dentinal bridge formation, pulp vitality and nonappearance of

inflammation in all the cases[22]. Though the exact pre-operative status of the pulp was never determined and it is likely the pulps were not actually irreversibly inflamed.

Numbers of laboratory studies have been exhibited to evaluate the biocompatibility of MTA by calculating various parameters such as proliferation and viability using dissimilar types of cells in direct and/or indirect contact with MTA. MTA in its newly mixed state shows a higher cytotoxicity [23, 24], which could be due to its high pH[25]. Therefore, it is important to develop biocompatible treatments directed at maintaining pulp vitality and increasing tooth longevity [26]. Based on the exceptional properties of MTA, another new bioactive calcium silicate-based cement of similar composition with modified properties to improve the handling capability and to reduce the setting time was introduced as Biodentine (Septodont, Saint-Maur-des-Foss´es, France). This material is encouraged in clinical use as a biomaterial for procedures like pulp capping, pulpotomies, and so forth. Biodentine has also shown promise as a cervical lining restoration and may be utilized for the successful management of perforations and internal and external resorptive defects and apexification and retrograde filling[27]. It also shows better-quality mechanical properties and reduced setting time of 12 min. The benefit of using Biodentine is that it is biocompatible and insoluble, has good mechanical properties, and provides a tight biological seal against the ingress of bacteria [28].

In our current case, an effort was made to use the growth factors to help in the repair of a tooth with pulpitis which is secreted from PRF slowly over a while. Autologous PRF placed in the pulp chamber after a pulpotomy procedure. A 2mm thick layer of MTA was placed over PRF and the final restoration of GIC cement was placed immediately. MTA was chosen in the current case as it is hydrophilic in nature and requires moisture to set, which is a promising property when there is a chance for moisture contamination in the clinical setting [29]. To prevent microleakage another coronal layer was placed. On 1, 3, 6, 12 months recall the tooth was asymptomatic. Follow-up radiographs revealed total resolution of the periapical rarefactions and a trabecular pattern approaching normal range. The condensing osteitis present preoperatively may take a long time to resolve, 70% of cases resolve over time, whereas 30% persisted indefinitely[30].

The probable theory behind the success of the existing case could be attributed to a study conducted by Wang et al. (2010)[26] that the pulp cells exist in pulp clinically diagnosed with pulpitis might still have stem cell potential similar to healthy pulp cells and consequently might be a resource for autologous pulp regeneration. These treasured findings suggest thrilling chances for biologically based therapeutic methods to dentin –pulp tissue repair as well as providing treasured insights into the process of how natural regenerative processes may be operating. Further research on this topic is required with regard to the histological assessment of such treated teeth on a larger sample size with regard to the histological assessment of such treated teeth on larger sample size.

Conclusion

The technology of slow polymerization of PRF & Fibrin acts as a favorable physiologic structure to support healing. Growth factors provide a blueprint for tissue regeneration within the tooth, thus creating new opportunities for biological approaches to dental tissue repair.

Apart from the chosen regenerative materials, the age, general health, diagnostic criterion, oral hygiene practices, economics, patient motivation, and compliance were other important factors that were focused on during the case selection while choosing for pulpotomy modality of treatment over conventional Endodontics.

Other contributing factors in the direction of the success of the treatment accomplished include stringent aseptic protocols, quick coverage of the exposed pulp stumps, appropriate regenerative scaffold, and a bacterial tight coronal double seal.

Within the limits of our present clinical study and based on the positive outcomes achieved in the present case, we can conclude that clinicians can safely rely upon advanced noninvasive, regenerative approaches to improve the standard of care delivered to the patients. However further studies and clinical trials on the efficiency of such procedures are still obligatory to reflect it as a mainstay of treatment.

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