

Coronal Pulpotomy Technique Analysis As An Alternative To Pulpectomy For Preserving The Tooth Vitality In Context To Tissue Regeneration: A Correlated Clinical Study Across 4 Permanent Molars

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ABSTRACT : Aim: *The purpose of our research was to assess the prognosis of the treatment performed using second generation platelet concentrates (PRF) and a new calcium silicate-based material (Biodentine) for coronal pulpotomy techniques.*

Methodology: *Pulpotomy procedure was carried out on 4 carious involved, permanent molars detected with acute irreversible pulpitis in 17- to 22-year-old patients. Taking into consideration the patient's age and the condition of the underlying pulp tissue, PRF pulpotomy was planned in view of preserving the vitality of the intact radicular pulps. Regenerative procedures with second generation blood matrices were chosen to encourage*

the recovery of the inflamed pulps. The follow-up examinations were conducted at 6, 12 and 24 months, revealing a better clinical and radiological result. Descriptive analysis was carried out to assess the prognosis all these teeth with subsequent follow ups.

Results: The clinical follow-up evaluation of the cases was met with a positive outcome. In addition, the digital radiographic examination (RVG) of the cases revealed an intact PDL space and a normal trabecular pattern of the bone. There was statistically significant dentinal barrier formation, which shows the healing response.

Conclusion: We can conclude that clinicians can safely rely upon advanced non-invasive, regenerative approaches to improve the standard of care delivered to the patients and can be considered as an alternative to conventional RCT.

Keywords Pulpotomy, PRF, Biodentin, Regenerative Endodontics

1. INTRODUCTION

Pulpotomy as a procedure has been described as removing the coronal part of the pulp which is vital by protecting the remaining radicular portion of pulpal vitality.¹ Coronal pulpotomy is that the treatment indicated in immature teeth with pulpal inflammation. the first objective of pulpotomy is to preserve radicular pulpal tissues which will help to complete apexogenesis in immature permanent teeth. per American Academy of Pediatric Dentistry (AAPD) guidelines “A pulpotomy is performed in an exceedingly tooth with extensive caries without evidence of radicular pathology when caries removal leads to a carious or mechanical pulp exposure”.²

With the appearance of bioactive materials, a brand new understanding on pulp regeneration and vascularization, and because of the technical advancement, many researchers are that specialize in the coronal pulpotomy in permanent teeth with irreversible pulpal inflammation as another treatment choice to passage therapy.³ There are variety of studies on coronal pulpotomy showing the success rate adore passage therapy in permanent teeth with pulpal diseases.⁴⁻⁶

A large amount of proteins is responsible for signalling as well as regulating the healing of pulp-dentinal complex. But understanding this complete process remains incomplete; however, it's known that platelets play a vital role not only in hemostasis, but also within the wound healing process.⁷

Many materials are studied regarding tissue engineering for regenerating pulp yet as nearby dentinal interface. one amongst the foremost promising materials is PRP (Platelet Rich Plasma). PRP has been reported to change the biomechanical and histologic properties of complex body part repair during acute injury response.⁸ Many investigations have shown that growth factors released by activated platelets can improve wound angiogenesis and enhance skin wound healing.⁹⁻¹³ the appliance of PRP in oral clinical research began within the late 1990s. within the field of oral medicine, PRP has been accustomed study bone tissue regeneration. the utilization of PRP in oral surgical practice could have beneficial outcomes like reduced bleeding and enhanced soft tissue healing and bone regeneration.¹⁴ It could also eliminate concerns of immunogenic reactions and disease transmission. On the opposite hand, the bioactive factors released by PRP also participate in anabolism, catabolism, and

proinflammatory and anti-inflammatory responses, a number of which also underlie the response.¹⁵ Consequently, PRP has been the choice when tissue regeneration is considered.

Biocompatibility of a dental material is an additional chief factor that must to be highlighted upon, precisely when it's utilized in vital pulp therapy. In an exceedingly performed animal study, the authors¹⁶ assessed the pulpal response of primary pig teeth against Biodentine when used as a pulp capping still as a pulpotomy material after 7, 28, and 90 days. Their results revealed that Biodentine has bioactive properties, encourages hard tissue regeneration, and provokes no signs of moderate or severe pulp inflammation responses. They further noted through their investigations that the fabric had the flexibility to take care of a successful marginal integrity because of the formation of hydroxyapatite crystals at the surface which improved its sealing ability.

Cytotoxicity of biomaterials has also been a matter of debate for scientists, especially those used for pulpotomy treatments. Hence, there's a continuing need for biologically based autologous materials to neutralize the side effects, if any, because of synthetic based biomaterials, to scale back the pulpal inflammation and to market faster healing.¹⁷

2. AIM OF THE STUDY

The purpose of our research was to assess the prognosis of the treatment performed using second generation platelet concentrates (PRF) and a new calcium silicate-based material (Biodentine) for coronal pulpotomy techniques.

3. METHODOLOGY

4 patients who visited our dental clinic who reported with mild lingering pain in a carious lesion and confirmed on radiograph with the lesion involving enamel, dentin as well as reaching the pulp as well. Patients were explained an alternative form of treatment to traditional RCT, i.e. treatment based on Biodentine as well as usage of PRF. The written consent was obtained from the patient. Their medical examinations were carried out to assess they are medically fit for this procedure.

PRF was prepared by drawing blood into a 10mL test tube without the addition of an anticoagulant. Hence, to prevent the blood from coagulating after coming in contact with the glass tube, it was centrifuged immediately using a table top centrifuge at 3000 rpm for 15mins.

The product thus obtained consisted of the three layers: the top most layer of acellular platelet poor plasma, the middle layer of platelet rich fibrin, and the bottommost layer of red blood corpuscles. The PRF was separated and put in the form of a membrane.

The tooth was anesthetized with an inferior alveolar nerve block using Lignocaine 2% with adrenaline and rubber dam isolation was achieved. Carious lesion was removed with the help of high speed airtor handpiece and the coronal part of pulp was taken out. The bleeding was eventually controlled with the help of saline solution. The PRF membrane attained subsequently after centrifugation of the patient's individual blood taken. Biodentine was put over PRF to an estimated thickness of 2mm and the final restoration was positioned using

direct composite restorative resin. Digital radiographs were taken and the patient was recalled after one day and assessed for the incidence of pain.

The follow-up period was conducted for duration of 6, 12 and 24 months. The patients were asymptomatic with clinical and radiological achievement when evaluated up to the respective follow-up intervals. At the end of one-year period, full coverage restorations, namely, porcelain fused metal crowns, were cemented as final definitive restorations. Crowns were placed after 12 months to ensure adequate favourable prognosis of the performed pulpotomy therapies. Descriptive statistics was utilized to see the change in symptomatology, formation of dentinal barrier as well as retainment of any pulpal vitality of teeth, tested with the help of EPT (Electric pulp tester). The data recorded was analysed with the help of SPSS 25.0.

4. RESULTS

The clinical follow-up evaluation of the cases was met with a positive outcome. (Table 1) In addition, the digital radiographic examination (RVG) of the cases revealed an intact PDL space and a normal trabecular pattern of the bone. It was observed that presence of any pain or swelling or discomfort was observed after 6 months of follow up of three of four patients (1.36 ± 0.9 , $p=0.02$) and was statistically significant when inter-variation analysis was carried out. However, the situation improved with subsequent follow up, with no evident symptoms by 24 months (2.07 ± 0.4 , $p=0.0311$) (Table 2) which shows that the symptoms improved drastically. To assess the vitality of the concerned molar teeth, electric pulp testing was carried out, in which at 6 months follow up EPT was negative in 3 out of 4 molars, however that is also subjective variation. At 12 months, all the molar teeth tested positive for vitality testing. In all of the cases, dentinal barrier formation was not evident on IOPA at 6 months follow up, whereas with subsequent follow up, there was evidence of radiopaque dentinal barrier formation ensuring the healing of pulpitis, which is subsequent response achieved with the use of PRP as well as bioactive materials. The results were statistically significant.

Table 1- Data recorded in the present study

	Patient 1 (Maxillary Molar)			Patient 2 (Maxillary Molar)			Patient 3 (Mandibular Molar)			Patient 4 (Mandibular Molar)		
	6 Mo.	12 Mo.	24 Mo.	6 Mo.	12 Mo.	24 Mo.	6 Mo.	12 Mo.	24 Mo.	6 Mo.	12 Mo.	24 Mo.
Absence of symptoms	yes	yes	yes	no	yes	yes	no	Yes	yes	no	yes	yes
Presence of intact PDL space	no	no	yes	no	no	yes	no	Yes	yes	no	no	yes
Formation of	no	yes	yes	no	yes	yes	no	Yes	yes	no	yes	yes

dentinal barrier												
Response to EPT	yes	yes	yes	no	yes	yes	no	Yes	yes	no	no	yes

*MO. – Months, EPT- Electric pulp tester

Table 2- Analysis based on subsequent follow up of patient

	6 months (Mean±SD)	P value	12 months (Mean±SD)	P value	24 months (Mean±SD)	P value
Absence of symptoms	1.36±0.9	0.02	1.222±0.7	0.028	2.07±0.4	0.0311
Presence of intact PDL space	1.22±0.3	1.21	1.9±0.22	0.07	1.33±0.8	0.04
Formation of dentinal barrier	2.67±2.3	0.043	3.21±0.3	0.035	2.59±0.7	0.0144
Response to EPT	3.98±1.8	0.12	2.87±1.2	0.15	3.33±1.4	0.196

*P<0.05 significant

5. DISCUSSION

Asgary et al. in their multicenter trial compared coronal pulpotomy, achieved using bioactive material calcium-enriched mixture (CEM), with RCT in permanent teeth with closed apex and irreversible pulpal inflammation. No change was observed in success rates between pulpotomy and RCT clinically at 6th and 12th months of follow-up, however, radiographically, the pulpotomy group performed exceptionally better than RCT (P < 0.001).¹⁸

Higher success rate of up to 90% was found in another study done by Alqaderi et al. during which MTA pulpotomy was conducted in children in permanent teeth that were indicated for RCT.¹⁹ A case report by Asgary on a molar tooth with irreversible pulpitis with condensing osteitis where treatment of coronal pulpotomy was carried out using CEM cement. The tooth was followed up for 2 years. The tooth was clinically asymptomatic, and complete healing of periradicular tissue passed off.²⁰ Taha et al. reported the success rates of 100% in one year and 92.7% at three years in their study with reference to outcome of MTA pulpotomy in mature permanent teeth during which pulp was exposed thanks to caries.²¹ In another study done by Simon et al. pulpotomy with MTA in permanent teeth was found to be highly successful (82% on two years).²² In their prospective study on complete coronal pulpotomy using Biodentine in permanent teeth with mature apices and irreversible pulpal inflammation at one year follow-up Taha and Abdulkhader found a high clinical success rate was of up to 100% and radiographic success of up to 93.8%.²³

Recent advances have broadened the scope of applications to supply the best possible treatment and permit more teeth to be salvaged. However, RCT in certain clinical situations

still pose a challenge to the clinician, because of the myriad complexities related to the treatment procedures. the foremost reliable way of relieving the acute pain of a patient with irreversible pulpitis is by performing emergency treatments like pulpotomy or pulpectomy.²⁴

The age of the patient is vital criteria for the choice of the patients with vital pulp therapies because older pulps are fibrous and fewer cellular with limited blood supply which changes the treatment outcome.²⁵ Taking into deliberation the direct influence on the success rate of such procedures, pulpotomy was planned for all the 4 selected patients with age ranges between 17 and 22 years to realize a predictable outcome.

In the present study, Biodentine was filled employing a single stage approach where the Biodentine was placed to bear with the pulp tissue and it had been allowed to line for 12–15mins and followed by the permanent restoration on the highest of it. Two-stage approaches may also be followed where the complete cavity is crammed with Biodentine and is then reduced to a base or substrate level for 1 week to six months later for the permanent restoration. except the chosen regenerative materials of choice, the age, general health, diagnostic criterion, oral hygiene practices, economics, patient motivation, and acquiescence were other important factors which were fixated on during the case selection while choosing pulpotomy modality of treatment over conventional Endodontics.

6. CONCLUSION

Clinician's interest, skill, intuition, and knowledge play a crucial role in the art of decision making to provide conservative, viable, and safe treatment alternatives such as pulpotomies over pulpectomies in irreversibly inflamed adult permanent teeth with closed apices. It was observed that regenerative as well as conservative procedures can help to improve the status quo of treatment in patients. Still need further academic evaluation so that this form of treatment can be validated even further.

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