# Comparative Analysis of Platelet-Rich Fibrin and Hydroxyapatite in Management of Peripical Inflammatory Lesions: A Clinical and Radiographic Analysis

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## ABSTRACT

**Introduction:** Periapical lesions in teeth can be seen in long-standing untreated endodontic infection. Study aimed to evaluate bone regeneration in periapical lesions using MTA as retrograde filling of material with or without Hydroxyapatite and Platelet-Rich fibrin(PRP), and a combination of Hydroxyapatite and Platelet-Rich fibrin in curetted periapical defects and evaluate the patients clinically at each recall visit.

**Material and Methods:** Thirty healthy patients of both genders, ages 20 and 40 years were included. the patient had to have a tooth where root canal therapy had failed and having periapical radiolucency, and periapical root end surgery was required. Patients were divided into three groups, with ten patients each, as follows: Group I — root end cavity was filled with MTA. Group II — root end cavity was filled with MTA followed by placement of hydroxyapatite in the curetted periapical defect., Group III — root end cavity was filled with MTA followed by placement of PRF in the curetted periapical defect. The patients were followed clinically and radiographically. In all the three groups, patient recall visits were scheduled after 1, 3, 6, and 9 months time interval for clinical and radiological examination.

**Results:** A healing was observed after 9 months in Group III followed by Group II and Group I. The clinical and. radiographic evaluation revealed that Group III (82.36%) patients showed significantly higher rate of bone regeneration with evidence of a trabecular pattern, at the end of 9 months followed Group II (65.16%), then Group I (60.12%).

**Conclusions:** Root end filling material contributes greatly to the success of surgical treatment and to improve healing of periapical defect we use host modulating agents such as PRF over grafts as these are autologous and contain growth factors which promote faster healing of periapical defects.


**Keywords:** Bone Regeneration; Hydroxyapatite; Periapical Lesion; Platelet-Rich Fibrin, MTA

## INTRODUCTION

The periapical surgery removes diseased soft tissue and use of different graft material enhances new bone formation at the defective site.[1] Formation of new bone occurs with repair or regeneration. The commonly used technique for regeneration is the use of bone replacement grafts. These grafts can promote tissue regeneration by different mechanisms. Bone replacement material should be inert, non carcinogenic, and should be dimensionally stable. It should help in bone formation and resorb slowly to permit the formation of the new bone.[2] Biphasic calcium phosphate ceramic is good biomaterials for bone healing and regeneration.[3] there are reports that have demonstrated healing with the formation of mature bone using this bone graft. To enhance the healing of periapical defects, modulating agents such as platelet concentrates –platelet-rich fibrin (PRF) is used. Blood sample were collected favorable for healing and immunity.[4] which contains growth factors necessary for cell migration, attachment, proliferation, and differentiation and promote the healing of hard and soft tissues.[5] Surgical endodontic treatment removes any associated extraradicular infection such as periapical granulomas and cysts. Purpose of this study was to evaluate and compare the healing of periapical defect after periapical surgery along white mineral trioxide aggregate (MTA) as retrograde filling material and using hydroxyapatite or PRF in curetted periapical defect.

## MATERIAL AND METHODS

The present study was conducted on thirty patients having periapical pathology in maxillary anterior teeth taken from the department of oral and maxillofacial surgery Govt Dental College and Hospital Srinagar. Ethical clearance was taken from the Ethical Committee of the Institute. The intraoral pradiographs were taken. Teeth selected had (i) radiolucency at the apex (minimum 0.5 cm) (ii) healthy periodontal tissue. Then Vitality of the tooth was checked before starting treatment. If the tooth found to be nonvital and met the criteria; then, it was selected for periapical surgical procedure.

### Procedure

Consent was taken from the patient before the procedure. Preoperative radiograph of the tooth was taken, and size of

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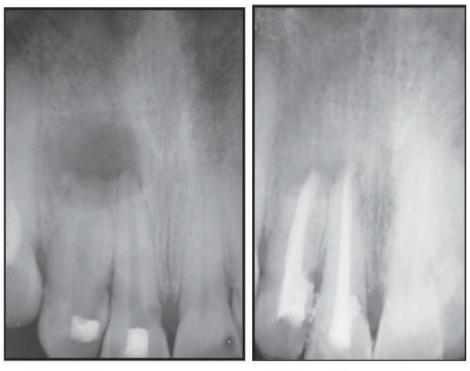
**How to cite this article:** Shah Shahi Jahan, Shabir Ahmad, Mushtaq Mohammad, Mubashir Younis, Sumera Gul, Muzafar Ahmad Bhat. Comparative analysis of platelet-rich fibrin and hydroxyapatite in management of peripical inflammatory lesions: a clinical and radiographic analysis. International Journal of Contemporary Medical Research 2018;5(2):B1-B4.

the radiolucency of the concerned tooth was measured using X-ray. Vitality of the tooth was checked using thermal and electric tests. Injection and diclofenac sodium 50mg were given intramuscularly ½ h to patient before the procedure to relieve the stress and increase the pain threshold. Surgical area was anesthetized by giving infraorbital and nasopalatine nerve blocks using 2% lignocaine with 1:100,000 adrenaline before endodontic procedure. The tooth was isolated using rubber dam application. Access cavity was prepared, and working length of canal was measured following Ingle's method. Root canal was prepared using crown-down technique. During instrumentation, copious irrigation was done with 3% sodium hypochlorite (NaOCl) solution alternating with normal saline. After thorough biomechanical preparation, tooth was obturated with gutta-percha cones following cold lateral condensation technique using AH Plus Sealer. Finally, access cavity was sealed with permanent restoration. Periapical surgery was performed under strict aseptic conditions. A crevicular incision accompanied by two releasing vertical incisions was given using a No. 3 Bard-Parker Scalpel and a No. 15 blade. A full thickness flap was reflected using periosteal elevator exposing the cortical bone. The exposed cortical bone over the periapical surgical site was removed with the help of Straight Hand piece having round bur revolving at slow speed and Constant irrigation. Cortical bone was removed so as to have better access to periradicular area. Infected periapical tissue was cleaned by using curettes, and bony cavity was cleaned. Root end retentive cavity was prepared using a round bur. The MTA was mixed and inserted as a root-end filling material using MTA carrier. In Group I, after the placement of MTA, no graft material was added in the periapical defect. In Group II, the same procedure was carried out till the placement of MTA, followed by placement of Hydroxyapatite graft in the periapical defect. In Group III, the same technique was carried out and MTA was placed; then, PRF was prepared freshly. Venous blood (around 10 ml) of patient was collected in vacutainer tube without anticoagulant. It was then placed in a centrifugal machine and rotated at 3000 rpm for 10 min. After centrifugation, upper layer which is straw-colored was removed. The middle part; fibrin clot was removed from the tube using tissue holding forceps and red blood cells attached part were scraped off from it and discarded. PRF was placed in the bony cavity using tissue holding forceps and adapted to the cavity walls Interrupted suturing was done. The postoperative instructions were given both in verbally and written then patient was discharged. Patient was instructed to report in case of swelling or pain. Sutures were removed 1 r 2 weeks after surgery.

Patient recall visits were scheduled after 1, 3, 6, and 9 months in all the three groups for clinical and radiological examination. On each recall, patient was examined clinically regarding postoperative discomfort, pain, sensitivity to percussion, and presence/absence of swelling. Radiographically, an intraoral periapical radiograph with X-ray Mesh Gauge placed onto the IOPA film was taken on each follow-up visit. Size of the radiolucency was measured each time and compared with preoperative radiograph.



Pre-op After 9 months

**Figure-1 and 2:** Group I- after the placement of MTA

## STATISTICAL ANALYSIS

Statistical analysis were done on data collected on different intervals. Paired t-test were employed to measure change in the size of radiolucency between groups.

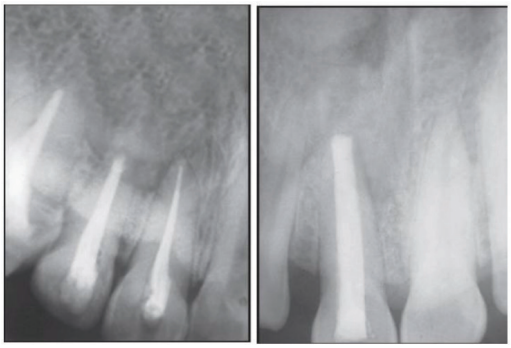
## RESULTS

A significantly higher healing results were observed after 9 months when apicoectomy was done using retrograde filling materials with PRF as a graft material in Group III (82.36%) followed by hydroxyapatite in Group II (65.16%) as compared to Group I, where no graft material was added and only periapical defect was curetted (60.12%). However, no significant difference was observed when comparing Group I with Group II ($P = 0.831$) and Group II with Group III ($P = 0.134$).

A significant difference was observed when comparing Group I with Group III ($P = 0.040$) [Table 1 and Figures 1-4].

| S. No | time | Group I | Group II | Group III | P | | |
|---|---|---|---|---|---|---|---|
| | | | | | Group I versus Group II | Group I versus Group III | Group II versus Group III |
| 1 | Pre- to post-operative | −34.24±14.71 | −33.14±24.43 | −61.71±46.41 | 0.997 | 0.168 | 0.147 |
| 2 | Pre- to after-1 month | −13.25±19.82 | −9.00±25.33 | −33.00±45.41 | 0.957 | 0.401 | 0.265 |
| 3 | Pre- to after-3 month | 13.24±26.04 | 19.66±21.62 | 23.11±31.79 | 0.867 | 0.718 | 0.959 |
| 4 | Pre- to after-6 month | 39.93±23.20 | 44.28±17.11 | 56.94±28.85 | 0.867 | 0.288 | 0.495 |
| 5 | Pre- to after-9 month | 0.12±22.22 | 65.16±13.30 | 82.36±18.82 | 0.831 | 0.040 | 0.134 |
| *Significant 0.04. *One-way ANOVA | | | | | | | |

**Table-1:** Comparison of percentage change in size of radiolucency at different time intervals between three groups



After 9 months After 9 months

**Figure-3:** Group II —Hydroxyapatite graft; **Figure-4:** Group III — PRF

## DISCUSSION

Periapical surgery helps in healing by removing pathological tissue.[6] the success rate of surgical treatment increases, when a good quality apical seal is maintained. Good Apical seal can be obtained by the use of root-end filling materials.[7] using a MTA as retrograde filling material over other materials. MTA has shown the highest apical healing (90.4%) in comparison to other root-end filling materials.[8] MTA also shows prevents leakage successfully than other root-end filling materials.[9]

In the this study, single visit root canal treatment was done to avoids repeated instrumentation, and prevents the occurrence of pain resulting from reinfection of canals from a leaky temporary restoration.[10] Cleaning and shaping of the canals were done. It permits straight access to the apical region, allows deeper penetration of irrigants, and allows better control over working length.[11] NaOCl was used as an irrigant because of its antimicrobial activity and its capacity to dissolve necrotic tissue remnants.[12] AH Plus sealer was used for good adhesive properties, lesser solubility, high radiopacity, and lesser toxicity.[13] Surgical procedure were performed after the completion of root canal. During root end resection and cavity preparation. It has been found that if we remove this apical 3mm part, 98% of canal ramifications and 93% of accessory canals are removed.[9] Following root end resection, apical part of root was prepared to increase the contact length of the material in the cavity and decreases the probability of apical leakage.[7] Calcium phosphates have been widely used in periapical surgery to enhance new bone formation. Calcium phosphate cement is bioactive cement and forms hydroxyapatite when moistened.[14] The histological examinations of calcium phosphate cement confirm the excellent bone biocompatibility and osteoconductive properties. The material did not shows any inflammatory response and allows new bone formation. In vivo studies its revealed that it forms osteoconductive apatite that has chemical and physical characteristics similar to bone, and is then replaced by natural bone.[15] PRF is an autologous graft of platelets on a fibrin meshwork that contains cytokines, leukocytes, and growth factors such as platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF-beta), vascular endothelial growth factor. TGF-beta and PDGF promote healing of both soft tissue and bone through collagen production. PDGF promotes angiogenesis, and releases growth factors from host tissue which enhances bone repair and regeneration. TGF-beta activates fibroblasts to produce collagen, endothelial cells for angiogenesis, chondro progenitor cells to produce cartilage. Fibrin serves as a scaffold for cell migration and platelet entrapment.[16] PRF has advantages over bone grafting materials as autologous, indispensable in tissue wound healing and acts as better space filler.[17] PRF is easy to obtain and is inexpensive. It has slow polymerization which leads to favorable healing.[18] Some patients complained of pain and swelling 2–3 days postoperatively after the surgical procedure. These findings are in concurrence with study done by Christiansen et al.[19] When patients treated with PRF and evaluated for clinical signs of pain, swelling, postoperative discomfort, and sensitivity to percussion, it was seen that all the treated patients were comfortable. The present study is in concurrence with the study conducted by Del Fabbro et al., who suggested that use of platelet concentrates lower levels of pain, swelling, and other symptoms.[20] The postoperative healing results were evaluated at 1, 3, 6, and 9 months radiographically and compared with preoperative radiograph. It was seen that there was decrease in the size of radiolucency with every follow-up in all the three groups with maximum decrease in size of radiolucency in Group C (82.36%) > Group B (65.16%) > Group A (60.12%). However, comparing Group A with Group B ($P = 0.831$) and Group B with Group C ($P = 0.134$) no significant difference was observed. While as when comparing Group A with Group C ($P = 0.040$) a significant difference was observed. Healing results I our study was same as in a study conducted by Jayalakshmi et al. where there was a predictable clinical and radiographic bone regeneration after using the combination of PRF with beta tricalcium after follow-up period of 3,6, 9, and 12 months.[21]

## CONCLUSION

It was concluded from this study that a good quality apical seal by using root-end filling materials contributes to the success of the treatment. The success rate can be modified and increased by using grafts, and various host modulating agents. Calcium phosphate cements used as grafts promotes the formation of new bone. However, PRF as graft is preferred as it is autologous and helps in healing by release of growth factors needed for the formation of bone.

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**Source of Support:** Nil; **Conflict of Interest:** None

**Submitted:** 10-02-2018; **Accepted:** 12-03-2018; **Published:** 23-03-2018