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Research Article

PLATELET-RICH FIBRIN AND HYDROXYAPATITE IN MANAGEMENT OF peripical INFLAMMATORY LESIONS: A COMPARATIVE CLINICAL ANALYSIS

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A R T I C L E I N F O

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A B S T R A C T

Aim and Objectives: 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.

Materials 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.

INTRODUCTION

Periapical lesions in teeth can be seen in long-standing untreated endodontic infection. 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 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.

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SUBJECTS AND METHODS

The present in study was conducted on thirty patients having periapical pathology in maxillary anterior teeth taken from the department of department of Periodontics 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 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 t intramuscularly ½ h to patient before the procedure to relieve the stress and increase the pain threshold of the patient. Surgical area was anesthetized by giving infraorbital and nasopalatine nerve blocks using 2% lignocaine with 1:200,000 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 composite resin 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 No. 6 Round Bur in a Straight Hand piece revolving at slow speed. Constant irrigation was done with sterile normal saline solution throughout the cutting process.

Adequate cortical bone was removed so as to have optimum access to periradicular area. Curettage of the infected periapical tissue was done using curettes, and bony cavity was cleaned. Apical 3 mm of the root was resected using a straight fissure bur. Root end cavity was prepared using a round bur. The MTA was mixed according to manufacturer's instructions 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 procedure was carried out till the placement of MTA; then, PRF was freshly prepared at this stage. Whole venous blood (around 5 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 straw-colored layer was removed. The middle part consisting of fibrin clot was removed from the tube using tissue holding forceps and the attached red blood cells 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 further. Postoperative radiograph was taken. The patient was discharged after giving postoperative instructions. Patient was instructed to report immediately in case of swelling and/or pain. Sutures were removed 1 week after surgery.

In all the three groups, patient recall visits were scheduled after 1, 3, 6, and 9 months 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. The data were collected and put to statistical analysis. Paired t-test and one-way ANOVA were employed to measure change in the size of radiolucency between groups.

RESULTS

A significantly higher rate of healing was 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 in the curetted periapical defect (60.12%). However, no significant difference was observed when comparing Group I with Group B (P = 0.831) and Group II with Group III (P = 0.134).

A significant difference was observed when comparing Group A with Group III (P = 0.040) [Table 1].

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

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

DISCUSSION

Periapical surgery promotes healing by removing most of the pathological tissue.[6] To increase the success rate of surgical treatment, it is important to maintain a good quality apical seal. Apical seal can be obtained by the use of root-end filling materials.[7] MTA is preferred as retrograde filling material over other materials. MTA has shown the highest healing rates (91.4%) in comparison to other root-end filling materials.[8] MTA also shows less leakage than other root-end filling materials.[9]

In the present study, single visit root canal treatment was done as it offers various advantages such as immediate obturation, 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 following crown-down technique. It permits straight access to the apical region, eliminates coronal interferences, removes the bulk of tissue and microorganisms before apical shaping, allows deeper penetration of irrigants, and allows better control over working length.[11] NaOCl was used as an irrigant because of its broad-spectrum antimicrobial activity as well as its capacity to dissolve necrotic tissue remnants.[12] AH Plus sealer known for its adhesive properties can achieve an adequate seal when used. It has the advantages of lesser solubility, high radiopacity, lesser toxicity, and can be removed from canal if necessary.[13] After the completion of root canal treatment, surgical procedure was performed. During root end resection, root end cavity was prepared. 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 3 mm of root was prepared. It increases the contact length of the material in

the cavity and decreases the probability of apical leakage.[7] Osteoconductive calcium phosphates have been widely used in periapical surgery to enhance new bone formation. Calcsium phosphate cement is bioactive cement that sets as hydroxyapatite when moistened.[14] The histological examinations confirm the excellent bone biocompatibility and osteoconductive properties of calcium phosphate cement. The material did not evoke any inflammatory response and allows new bone formation. In vivo studies reveal that it sets into an osteoconductive apatite that has chemical and physical characteristics similar to bone, which is further replaced by natural bone.[15] PRF is an autologous concentrate 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, and epidermal growth factor. TGF-beta and PDGF promote healing of soft tissue and bone through stimulation of collagen production. PDGF promotes angiogenesis, activates macrophages that initiate the release of growth factors from host tissue which enhances bone repair and regeneration. TGF-beta activates fibroblasts to induce collagen formation, endothelial cells for angiogenesis, chondro progenitor cells for cartilage and mesenchymal cells to increase the population of wound healing cells. Fibrin serves as a scaffold for cell migration and platelet entrapment.[16] Use of PRF has certain advantages over bone grafting materials. Being autologous, it is indispensable in tissue wound healing and acts as better space filler.[17] PRF is easy to obtain and is inexpensive. Its slow polymerization leads to favorable healing.[18] Clinically, some patients complained of pain and swelling 1–2 days postoperatively after the surgical procedure. These findings are in concurrence with study done by Christiansen et al.,[19] who demonstrated that pain following periapical surgery tends to peak on the operational day, may get pronounced 1–2 days postoperatively. When patients treated with PRF were evaluated for clinical signs of pain/swelling, postoperative discomfort, and/or sensitivity to percussion all the treated patients were comfortable. The present study is also in concurrence with the study conducted by Del Fabbro et al., who suggested that use of platelet concentrates is related to lower levels of pain, swelling, and other symptoms.[20] The healing results were radiographically evaluated at 1, 3, 6, and 9 months postoperatively and compared with preoperative radiograph. There was a 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, no significant difference was observed when comparing Group A with Group B (P = 0.831) and Group B with Group C (P = 0.134). A significant difference was observed when comparing Group A with Group C (P = 0.040). Healing results are in concurrence with 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 the study that a good quality apical seal can be obtained using root‑end filling materials contributing to the success of the treatment. To further enhance the success rate, grafts, and various host modulating agents can be used. Calcium phosphate cements used as grafts are bioactive materials that promote the formation of new bone. However, PRF is preferred over grafts as it is autologous and promote faster healing by release of growth factors needed for the formation of bone.

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