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Original Research Article

A Comparative Evaluation of Postoperative Symptoms and Limitations in Function after Periradicular Surgery with and without use of Platelet Rich Fibrin as an Adjunct –A Randomized Clinical Trial

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Abstract

Background and objectives: All surgical procedures produce some secondary effects such as pain, swelling, and some functional impairments like difficulty in chewing mouth opening, speaking, sleeping, etc. Controlling postoperative discomfort may improve the patient's quality of life and acceptance of the treatment. The goal of this randomized single-blind trial was to see if using platelet-rich fibrin during endodontic surgery had a positive impact on pain and other aspects of the patient's quality of life in the first week after surgery. ***Methods:*** Fifteen patients with periapical lesions were treated with endodontic surgical procedures (control group). In another 15 patients, platelet-rich fibrin was placed into the bone defect in the form of a clot, and a suture was applied in addition to the surgical procedure (test group). During the first week after surgery, all patients completed a questionnaire to assess their major symptoms and daily activities. The results of the two groups' questionnaires were statistically compared. ***Results:*** The test group reported less pain, symptoms (swelling and bad taste), and functional activities compared with the control group but the difference was not statistically significant. ***Conclusion:*** The adjunct of platelet-rich fibrin to the endodontic surgical procedure produced some beneficial effects on patients' quality of life during the early postoperative stage. There were insufficient data in the literature and more clinical trials with larger samples have to be carried out in the future to find out the outcome

Keywords: Endodontic surgery, growth factors, Periapical lesion, Platelet-rich fibrin.

INTRODUCTION

Dental care primarily aims preservation and restoration of natural dentition. When teeth have irreversible pulp disease the best course of action is root canal treatment. Chemomechanical disinfection of the root canal system remains the main purpose of endodontic treatment, thereby eliminating necrotic tissues and decreasing the bacterial load. Although conventional treatment must always be considered first, a surgical approach, on specific occasions, can be indispensable. Endodontic surgery usually involves resection of the root apex, followed by preparation and filling of the root end canal. Over the years considerable advances have been made in the endodontic field. The introduction of an operating microscope, angled ultrasonic instruments, and new root end-filling materials are among them. Following the introduction of microsurgical techniques in endodontics, there has been a surge in interest in developing protocols to improve root-end management1 [1]. Conversely, less attention has been paid to the surgical management of soft tissues and patient-related outcomes in the early post-operative phase [2-4]. Endodontic surgery, like all oral surgical procedures, causes secondary effects such as pain and inflammation, the severity of which is determined by the amount of tissue damage caused. Few studies have examined postoperative discomfort after endodontic surgery. A recent randomized study has reported that the choice of the incision technique might affect the patient's quality of life in the postoperative phase, suggesting that proper soft tissue management could be one of the critical factors in the control of postsurgical discomfort [5].

In recent years autologous platelet concentrates (APCs) have been used in oral surgery to enhance the healing rate in bone regeneration because of their high content of growth factors [6, 7]. Although their efficacy in improving hard tissue healing is still debated because contrasting results have been reported by different studies, favorable effects of platelet concentrate on soft tissues have been frequently observed [8-11].

A Cochrane review shed light on the positive effect of APCs upon postoperative inflammation and pain in endodontic surgery [12]. The implementation of APCs as an adjunct to oral surgery was reported to add beneficial effects in terms of wound healing in periodontal intra-bony defects and pain relief in extraction sockets [13-15]. Platelet rich plasma (PRP) and plasma rich in growth factor (PRGF) were the earlier generations of APCs. We used a second generation platelet rich fibrin (PRF) over PRP or PRGF because the former is simple to prepare, place and is strictly autologous [16-18]. There are few well-powered studies on endodontic surgery using PRF-based matrices. The aim of the present randomized controlled clinical trial is to evaluate the postoperative discomfort in patients undergoing apical surgery, either by leaving the apical surgical cavity empty or by filling it with the PRF gel. The null hypotheses were that periapical surgical defects filled with the PRF gel experienced the same postoperative discomfort as that without PRF application.

MATERIALS AND METHODS

Patient selection

Ethical approval was obtained from the Institutional ethical committee and informed consent was obtained from all the patients. Patients requiring endodontic surgical treatment were recruited for 18 months in the department of conservative dentistry, government dental college, Kozhikode. The patients having no general medical contraindications for oral surgical procedures; the patient having only maxillary tooth that requires periradicular surgery; the diameter of the bone defect is taken from the radiograph, as 15mm-20mm; the non- surgical re-treatment judged unfeasible or previously failed; the tooth having adequate final restoration without clinical evidence of coronal leakage were included in the study. Presence of any kind of pathosis associated with vertical root fracture; presence of through and through lesion, diagnosed preoperatively by periapical radiographs, finger palpation, bone probing; perforation of furcation area or lateral canal walls; moderate to severe periodontal bone loss, detected with a periodontal probe were excluded from the study.

Surgical Procedure

All surgical interventions were carried out by a single surgeon. 2% Lidocaine with epinephrine 1:100,000 were used as the anesthetic agent. The flap was designed as a full-thickness mucoperiosteal tissue flap. Two releasing vertical incisions were placed in one tooth distal to the tooth to be treated, as well as a horizontal incision involving 4–5papillae. During root-end management, the flap was mobilized, reflected, and gently retracted. A retractor was placed on the exposed cortical bone after flap reflection, with light but firm pressure functioning as a passive mechanical barrier to the reflected tissues. The flap was frequently irrigated with sterile saline to prevent dehydration of the periosteal surface (Figure 2).

Using a circular bur with a modest rotating speed, surgical access to the root was established through cortical bone. The cortical bone was shaved away using a brush stroke technique. Under continual sterile water irrigation, little pressure was applied. The bur was kept away from the osseous surface for as long as possible. Curettes of various varieties were used to eradicate the periradicular lesion (Figure 3). For histologic diagnosis, the excised lesion was put in a 10% formalin solution. After exposing the root end, a straight fissure bur within a handpiece was positioned at a 45-degree angle to the root's long axis to bevel the root end. After bevelling the root-end cavity, a no.331/2 bur was used to prepare it to a length of 2 to 3mm. Root-end cavity was dried with a paper cone. Finally, the root end was filled with mineral trioxide aggregate (ProRoot MTA; Dentsply Maillefer) (Figure 4). In the control group, the flap was closed and sutured with nonabsorbable silk 3-0 (Ethicon Inc, Johnson & Johnson LTD.,). In the test group, PRF gel was prepared as described below and applied in the bone defect before repositioning and suturing the flap (Fig 5). Antibiotics were prescribed during the 5 days postoperatively (amoxicillin 500gm every 8 h). The choice to use analgesics was left to the patient. Sutures were removed within 7days from surgery

Preparation and Application of PRF

The PRF gel was prepared following the protocol by Choukroun *et al*., About 5 ml of whole venous blood was collected in a tube with a 6 ml capacity without anticoagulant. The sample then immediately centrifuged for 10minutes in a centrifugal machine at 3000 revolutions per minute. Centrifugation produced three layers: red lower fraction containing red blood cells, higher straw coloured cellular plasma, and middle fraction containing fibrin clot. The produced clot was extracted from the tube by using forceps.

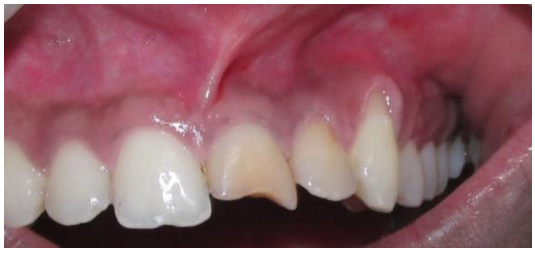

Figure 1: Preoperative View

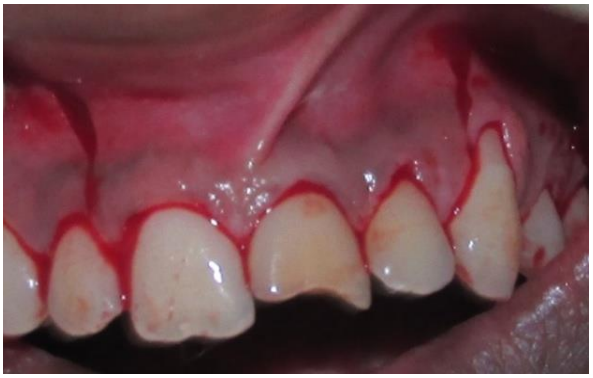

Figure 2: IncisionFigure

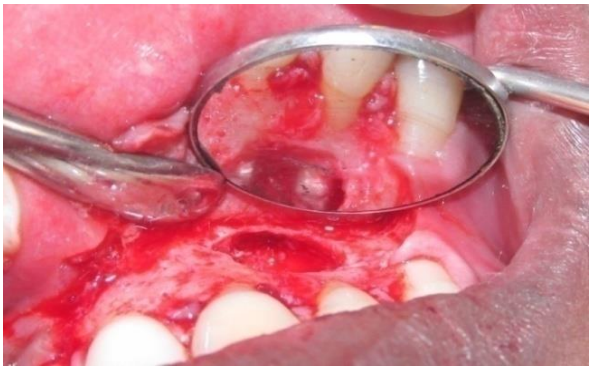

Figure 3: Retrofilling

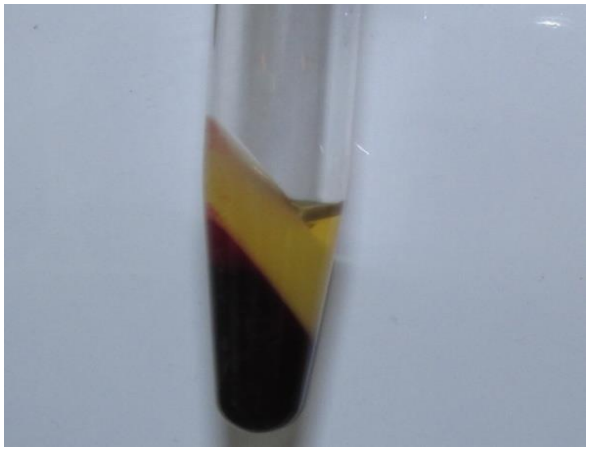

Figure 4: PRF clot prepared

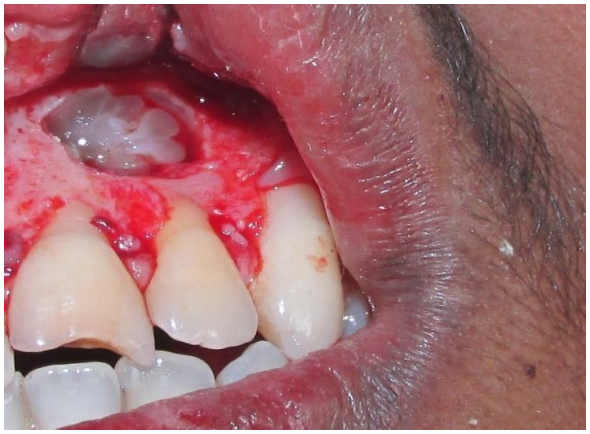

Figure 5: PRF clot placed

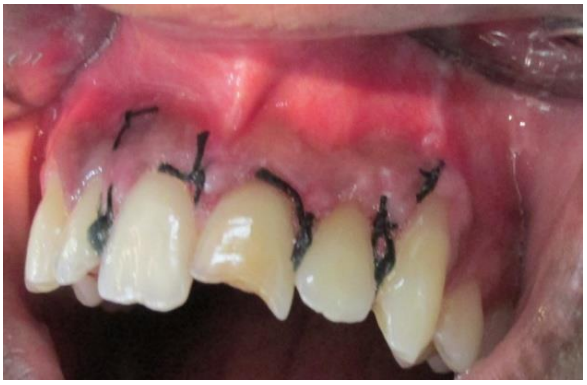

Figure 6: Suture placed

Evaluation of follow up:

After the surgical procedure a questionnaire which was previously prepared to evaluate postoperative limitations in function as well as pain and other symptoms given to each of the patients. The pain was assessed using a VAS scale in which 0=no pain and 10=the worst pain. For assessing other symptoms the answers were based on a 5-point Likert-type scale ranging from 0-4 in which 0=none (no postoperative symptomatic difficulty) and 4=very much (the worst). Patients were instructed to complete questionnaires every day for seven days, beginning on the day after surgery. The surveys were returned on the day of the one-week follow-up appointment for suture removal.

Statistical Analysis

The statistician was blinded to groups, meaning that the statistical analysis was performed considering 2 sets of data without knowing which one belonged to the test group and which to the control group. This was disclosed by the principal investigator after the completion of the analysis. The Fisher exact test was used to assess statistically the difference between groups for symptoms (e.g., swelling, bad taste) and other functional impairments (difficulty in chewing, sleeping, mouth opening, and speaking) on each postoperative day. The difference between the 2 groups for pain on each postoperative day was assessed by using the Mann-Whitney test. The statistical analysis was performed using commercially available software (SPSSs 11, SPSS Inc, Chicago, IL, USA). The significance in level was set at P = .05.

Observation and results

Thirty patients were included in this single blind randomized clinical study. All patients filled out the questionnaire completely and returned after 7 days of surgery. All patients reported some degree of discomfort because of pain, swelling, and other functional impairments mainly on days 1 and 2 postoperatively

The pain was maximum on the first day of surgery in both groups and there was a significant decrease in pain from day 2 in both groups. The group treated with platelet rich fibrin reported less pain than

the control groups in the first 2days. But the difference was not statistically significant. Figure 8 shows the levels of pain reported in the first week after surgery.

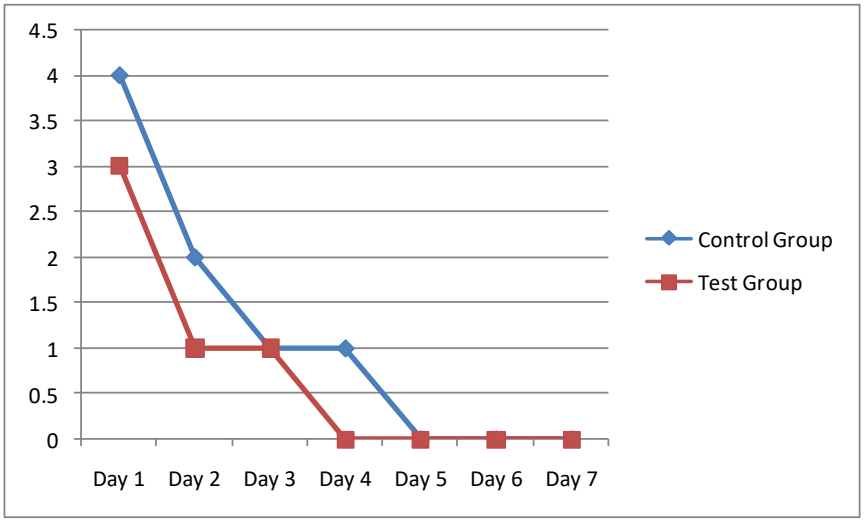

Figure 8: Levels of pain reported one week after surgery

Table 1: Given the results of symptoms and other functional activities, respectively

	Day 1		Day 2		Day 3		Day 4		Day 5		Day 6		Day 7	
	Control	Test	Control	Test	Control	Test	Control	Test	Control	Test	Control	Test	Control	Test
swelling														
None	13.3%	20%	13.3%	6.7%	6.7%	6.7%	20%	13.3%	26.7%	33.3%	53.3%	66.7%	80%	86.7%
Little	60%	46.7%	6.7%	6.7%	13.3%	33.3%	33.3%	73.3%	60%	60%	40%	33.3%	20%	13.3%
Some	20%	6.7%	26.7%	60%	**13.3%**	**46.7%**	33.3%	13.3%	6.7%	6.7%	6.7%	_	_	_
Quite a bit	6.7%	26.7%	33.3%	26.7%	**53.3%**	**13.3%**	13.3%	_	6.6%	_	_	_	_	_
Very much	20%	_	13.3%	_	_	_	_	_	_	_	_	_		
Bad taste														
None	33.3%	40%	33.3%	80%	40%	86.7%	53.3%	93.3%	86.7%	93.3%	86.7%	93.3%	93.3%	100%
Little	46.7%	40%	**46.7%**	**20%**	**40%**	**13.3%**	**46.7%**	**6.7%**	6.7%	6.7%	13.3%	6.7%	6.7%	_
Some	13.3%	20%	13.3%	_	13.3%	_	_	_	6.7%	_	_	_	_	_
Quite a bit	6.7%	_	_	_	6.7%	_	_	_	_	_	_	_	_	_
Very much	_	_	6.7%	_	_	_	_	_	_	_	_	_	_	_
Sleeping difficulty														
None	40%	66.7%	53.3%	86.7%	60%	93.3%	80%	100%	86.7%	100%	93.3%	100%	93.3%	100%
Little	40%	26.7%	26.7%	13.3%	26.7%	6.7%	20%	_	13.3%	_	6.7%	_	6.7%	_
Some	13.3%	6.7%	6.7%	_	6.7%	_	_	_	_	_	_	_	_	_
Quite a bit	6.7%	_	13.3%	_	6.7%	_	_	_	_	_	_	_	_	_
Very much	_	_	_	_	_	_	_	_	_	_	_	_	_	_
Chewing														
None	6.7%	6.7%	6.7%	13.3%	13.3%	40%	33.3%	73.3%	60%	80%	86.7%	86.7%	86.7%	86.7%
Little	33.3%	53.3%	46.7%	73.3%	60%	53.3%	53.3%	26.7%	26.7%	20%	6.7%	13.3%	6.7%	13.3%
Some	20%	26.7%	33.3%	13.3%	26.7%	6.7%	13.3%	_	13.3%	_	6.7%	_	6.7%	_
Quite a bit	33.3%	13.3%	13.3%	_	_	_	_	_	_	_	_	_	_	_
Very much	6.7%	_	_	_	_	_	_	_	_	_	_	_	_	_
Mouth opening														
None	6.7%	6.7%	13.3%	33.3%	20%	66.7%	40%	80%	60%	80%	86.7%	93.3%	86.7%	100%
Little	40%	80%	46.7%	60%	60%	26.7%	46.7%	20%	26.7%	20%	6.7%	6.7%	6.7%	_
Some	33.3%	6.7%	33.3%	6.7%	20%	6.7%	_	_	6.7%	_	_	_	_	_
Quite a bi	6.7%	6.7%	_	_	_	_	13.3%	_	6.7%	_	6.7%	_	6.7%	_
Very much	13.3%	_	6.7%	_	_	_	_	_	_	_	_	_	_	_
Speaking														
None	13.3%	6.7%	6.7%	26.7%	33.3%	60%	33.3%	80%	73.3%	80%	86.7%	93.3%	86.7%	100%
Little	33.3%	73.3%	46.7%	73.3%	46.7%	40%	**53.3%**	**20%**	13.3%	20%	6.7%	6.7%	_	_
Some	20%	20%	**33.3%**	_	20%	_	6.7%	_	6.7%	_	_	_	6.7%	_
Quite a bit	26.7%	_	6.7%	_	_	_	6.7%	_	6.7%	_	6.7%	_	6.7%	_
Very much	6.7%	_	6.7%	_	_	_	_	_	_	_	_	_	_	_

DISCUSSION

Platelet concentrates were originally used for treating and preventing hemorrhage caused by severe thrombopenia in transfusion medicine is now emerged as an innovative autologous product that enhances tissue healing and regeneration. A common feature of these products is their higher than baseline platelet concentration, which fastens wound healing and is responsible for the regeneration of both hard and soft tissues. Their effects are achieved through the continuous local release of a wide range of growth factors required for physiologic wound healing and tissue repair processes. Growth factors are biological mediators that regulate cellular events (such as migration, proliferation, and differentiation), extracellular matrix synthesis, and angiogenesis [16-18]. Platelets also release several other substances with different biological actions, for example, contribute to the host defense mechanism at the wound site by delivering signalling peptides that attract macrophage cells [19]. Platelet concentrates have also been shown to have antimicrobial activity against several bacterial species involved in oral infections [20, 21]. Some platelet concentrates may also contain trace amounts of leukocytes, which produce interleukins that are involved in the nonspecific immune response [22, 23].

The original concept leading towards the preparation of platelet concentrates was that concentrated platelets and autologous growth factors could be collected in plasma solutions that could then be utilized in a surgical site to promote local healing [24, 25]. It was given the popular working name platelet-rich plasma (PRP), introduced in the late 1990s. Around the same time period, Anitua et al. formulated a second platelet concentrate also utilizing anticoagulants termed platelet-rich growth factor (PRGF) [26, 27]. Several factors have been shown to limit the use of PRP and PRGF. Their preparation requires the additional use of bovine thrombin or CaCl2 in addition to coagulation factors. Furthermore, the preparation must be centrifuged in two separate stages to increase platelet concentration without the incorporation of leukocytes (sometimes requiring 1 h). It has further been reported that the liquid nature of PRP also complicates its handling and reduces its potential application since it must be utilized in combination with other biomaterials. Lastly, the clinical potential for bone regeneration with PRP is limited having a very short release of growth factor profile. All these limitations have led to the emergence of a second-generation platelet concentrate termed PRF fabricated from 100% autologous sources. Advantages of PRF over include the simplicity of its preparation and its implementation and is strictly autologous. So the presented study used PRF instead of PRP or PRGF

In the present study pain reported by both groups was maximum on the first day and from day 2 onwards there was a significant decrease in pain in both groups. The group treated with platelet rich fibrin have less pain than the control group. But the difference was not statistically significant between the 2 groups. These findings are in more or less agreement with a recent report from Soto-Peñaloza *et al.*, [28] involving the use of A-PRF in endodontic surgery afforded less variable pain perception but the difference in pain was not statistically significant. Meschi *et al*., [29] involving the use of leukocyte- and platelet-rich fibrin (L-PRF) and an occlusive membrane in endodontic surgery, found no statistically significant differences in terms of improvement in quality of life during the first week of postsurgery. In a clinical trial of Del Fabbro *et al*., [30] plasma rich in growth factors was applied in the test group and no APC in the control group. The patients in the test group had a significantly lower VAS score during the first 3 days post RES. In another (pilot) study [31] platelet-rich fibrin was used in the test group as grafting method. The patients in the test group had less pain 2 to 6 h post-operatively and less swelling until 5 days post RES, compared to the control group (no grafting). Nevertheless, both studies cannot be compared with each other or with this RCT, mainly due to the application of different types of APCs, assessment of different types of outcome variables, administration of AB post surgery in the current RCT, and level of bias.

In the present study swelling reported was maximum on days 2 and 3 after surgery in both groups. The group treated with platelet rich fibrin reported comparatively less swelling than the control group. There was a statistically significant difference between the two groups on day 3 with the group treated with platelet rich fibrin showed less swelling. Some of the biological substances released by platelet granules, such as the lysophospholipid sphingosine-1-phosphate, have the property of modulating the permeability of microvessels, which could explain the less swelling observed in the test group in the present study. In the present study in order not to influence the compilation of the questionnaire, patients were not informed of the possible effect of PRF regarding pain and swelling control. Most clinical studies revealed the use of platelet rich plasma have improved the postoperative quality of life by reducing pain, swelling, and other functional impairments. Literature studying platelet rich fibrin on possible effects on quality of life is less. More clinical trial with large sample size is needed to confirm the effects of platelet rich fibrin on the outcome.

CONCLUSION

The results of this study showed that the group treated with platelet rich fibrin reported less pain than the control groups in the first two days but the difference was not statistically significant. Differences in patients' responses in the other health-related quality of life questionnaire were statistically significant in favour of PRF treatment only for the presence of swelling on third day(p=.028)or bad taste in the mouth

on day 2(p=.034)day3(p=.035)day4(p=.018), and difficulty in speech on day 2(p=.014),day4(.034).Other functional impairments like difficulty in chewing, difficulty in mouth opening and sleeping were in favor of PRF treatment but the difference was not statistically significant.

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