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Analysis of Alveolar Crest Reduction Post Extraction with the Use of Platelet Rich Fibrin (PRF)

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Abstract

One of the treatments that can be done to treat dental and oral diseases is tooth extraction. However, this procedure can cause significant changes in the dimensions of the alveolar ridge that are unfavorable in subsequent oral rehabilitation. One of the most important things is the preservation of the remaining alveolar ridge after the tooth extraction procedure. The use of Platelet Rich Fibrin (PRF) for the regeneration of soft and hard tissue in wound healing, in the form of immune concentrate and platelets obtained from a single fibrin membrane which contains all the blood constituents useful for healing and immunity. This research is an unblinded, randomized clinical trial with a sample size of 36 patients undergoing tooth extraction. To see the effect of ridge resorption analysis, namely the reduction of the alveolar crest with PRF application. Each research sample is analyzed at each evaluation time. There was a significant difference in alveolar crest reduction in the treatment and control groups which was found in the mesial region (post-extraction days 60 and 90) and distal region (post-extraction days 30, 60 and 90) with a significance value $p<0.05$. There was a significant difference in the periapical x-ray image in the reduction of the post-extraction alveolar crest in the PRF application group, with better results compared to the group without PRF.

Keywords: *Tooth Extraction, Alveolar Crest, Platelet Rich Fibrin, Resorption, Ridge*

Introduction

Tooth extraction is one of the most common dental procedures performed in the field of dentistry and this procedure can cause significant changes in the dimensions of the alveolar ridge. After a tooth is extracted, it will leave scar tissue, namely the tooth socket which is composed of severed cortical bone and periodontal ligament (Damayanti & Yuniarti, 2016).

One of the most important concerns is the preservation of the remaining alveolar ridge after tooth extraction procedures, the failure of which often leads to disruption of implant placement and other rehabilitation measures. Prevention of post-extraction alveolar bone loss was first described by Greenstein and Ashman and Bruins in 1985. Healing of the extraction socket consists of bone and soft tissue with maximum dimensional changes occurring during the first three months (Cohen, 2007; Marrelli & Tatullo, 2013).

Tooth extraction has various side effects like pain, bleeding, swelling, infection, etc. Wound healing during tooth extraction is characterized by bone loss as a natural process.

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In addition, tooth extraction will cause recession around adjacent teeth and hinder functional and aesthetic prosthetic rehabilitation. PRF has been shown to play an important role in tissue healing by releasing growth factors from alpha granules, regulating cells such as cell adhesion, migration, proliferation, differentiation, and extracellular matrix deposition. Major changes occur within the first year after extraction, but most of the bone resorption occurs within only three months (Suttapreyasri & Leepong, 2013; Moraschini & Barboza, 2015).

The use of Platelet Rich Fibrin (PRF) in dentistry shows an increase in the wound healing process in soft and hard tissue after tooth extraction, so it can be an extraction socket preservation option that is useful for more stable socket rehabilitation. Based on this, the researchers wanted to see the comparison of resorption or reduction of the alveolar crest post extraction with the application of Platelet Rich Fibrin (PRF) and without the application of Platelet Rich Fibrin (PRF).

Methods

This research is an unblinded and randomized clinical experimental study, with a post test only control group design to determine the comparison of alveolar crest reduction through periapical x-ray of research subjects who underwent tooth extraction at the Unhas Oral Dental Education Hospital. The research was conducted in November 2022 - March 2023 and the research location was carried out at the Unhas Oral Dental Education Hospital.

Data analysis was carried out using SPSS version 27 software. Subject characteristics were analyzed descriptively first. The effect of PRF application on patients on each research outcome at each time has been determined using the T-Independent statistical test for normally distributed and homogeneous data. If one of the assumptions is not met then use the Mann-Whitney Test.

Results and Discussion

The sample for this research consisted of 36 samples which were divided into 2 groups, namely the treatment group and the control group. The division of respondents based on characteristics aims to assess several general characteristics of the sample including group, region, gender, diagnosis and age. Table 1 shows that based on group characteristics, the subjects in the control and treatment groups were balanced, namely 18 subjects (50.00%). Judging from the regional characteristics, the majority of subjects were in the mandibular region, namely 24 subjects (66.67%). Judging from gender characteristics, most of the subjects were female, namely 25 subjects (69.44%). Judging from the diagnostic characteristics, the majority of subjects were diagnosed with Pulp Gangrene, namely 19 subjects (52.78%). Judging from age characteristics, the majority of subjects were 18 – 25 years old, namely 18 subjects (50.00%).

Table 1. Sample Distribution Based on Patient Characteristics

Characteristics	Sample	
	n	%
Group		
Control	18	50.00
Treatment	18	50.00
Region		
Mandibula	24	66.67
Maksila	12	33.33
Gender		

Man	11	30.56
Woman	25	69.44
Diagnosa		
Gangren Pulpa	19	52.78
Gangren Radix	11	30.56
Gigi Vital	2	5.56
Nekrosis Pulp	4	11.11
Age		
18 - 25 Years	18	50.00
26 - 33 Years	11	30.56
>33 Years	7	19.44

Comparison Test

Comparison between changes in Alveolar Crest reduction over time in the tooth area using the T-Independent statistical test for normally distributed and homogeneous data, if one of the assumptions is not met then use the Mann-Whitney test.

Comparison of Groups Based on Mesial and Distal Region Time

In this section the researcher wants to see group comparisons including control and treatment patients. The comparisons are grouped by time. The test results were obtained as follows:

Table 2. Comparison of groups by time

Area Tooth	Time	Treatment		Control		*P-Value*
		n	(Mean+SD)	n	(Mean+SD)	
Mesial	Post OP	18	(0.651+0.437)	18	(0.458+0.261)	0.118*
	POD 30	18	(1.588+0.544)	18	(1.816+0.421)	0.170*
	UNDER 60	18	(2.382+0.634)	18	(3.221+0.565)	0.000*
	UNDER 90	18	(3.434+0.701)	18	(4.868+1.058)	0.000*
Distal	Post OP	18	(0.542+0.443)	18	(0.494+0.283)	0.837**
	POD 30	18	(1.361+0.588)	18	(1.757+0.407)	0.025*
	UNDER 60	18	(2.294+0.769)	18	(3.154+0.814)	0.003*
	UNDER 90	18	(3.391+0.85)	18	(5.146+0.854)	0.000*

*T-Independent test; ** Mann-Whitney test

The results of the analysis of the mesial area (Table 2) showed that tooth extraction at Post OP and POD 30 obtained a p-value greater than $\alpha = 0.05$, which means that in patients with tooth extraction with PRF application and without PRF there was no significant difference or with In other words, the effect of reducing the mesial alveolar crest experienced by patients with and without PRF application at Post OP and POD 30 can be said to be the same. What is different is that at POD 60 and POD 90, the p-value was smaller than $\alpha = 0.05$, which means that in patients with tooth extraction with PRF application and without PRF there was a significant difference or in other words the effect of decreasing the alveolar crest in the mesial area experienced Patients with PRF application and without PRF at POD 60 and POD 90 can be said to be different. This means that the effect of decreasing the alveolar crest in the mesial area begins to differ when entering POD 60, so it can be interpreted that at POD 60 the effect of decreasing the alveolar crest of patients with PRF and without PRF has shown differences.

For the distal area, the results of the analysis showed that during tooth extraction during post OP, a p-value was greater than $\alpha = 0.05$, which means that in patients with tooth extraction with PRF application and without PRF there was no significant difference or in other words a decreasing effect. The distal alveolar crest experienced by patients with PRF application and without PRF during Post OP can be said to be the same. What is different is that at POD 30, POD 60, and POD 90, the p-value was smaller than $\alpha = 0.05$, which

means that in tooth extraction patients with PRF application and without PRF there was a significant difference or in other words the effect of reducing the alveolar crest. The distal areas experienced by patients with PRF application and without PRF at POD 30, POD 60, and POD 90 can be said to be different. This means that the effect of decreasing the alveolar crest in the distal area begins to differ when entering POD 30, so it can be interpreted that at POD 30 the effect of decreasing the alveolar crest of patients with PRF and without PRF has shown differences.

Group Comparison by Region and Time

In this section the researcher wants to see group comparisons including control and treatment patients. These comparisons are grouped by region and time.

Table 3. Group Comparison by Region and Time

Dental Area	Region	Time	Treatment		Control		*P value*
			n	(Mean+SD)	n	(Mean+SD)	
Mesial	Mandibula	Post OP	11	(0.744+0.524)	13	(0.436+0.28)	0.080*
		POD 30	11	(1.694+0.598)	13	(1.834+0.459)	0.523*
		UNDER 60	11	(2.563+0.674)	13	(3.159+0.635)	0.036*
		UNDER 90	11	(3.699+0.668)	13	(4.706+1.131)	0.017*
	Maksila	Post OP	7	(0.504+0.206)	5	(0.516+0.219)	0.924*
		POD 30	7	(1.423+0.434)	5	(1.768+0.341)	0.062**
		UNDER 60	7	(2.097+0.475)	5	(3.382+0.319)	0.000*
		UNDER 90	7	(3.019+0.565)	5	(5.29+0.782)	0.000*
Distal	Mandibula	Post OP	11	(0.581+0.525)	13	(0.521+0.325)	0.794**
		POD 30	11	(1.409+0.693)	13	(1.699+0.432)	0.224*
		UNDER 60	11	(2.282+0.811)	13	(2.984+0.867)	0.054*
		UNDER 90	11	(3.394+0.854)	13	(5.007+0.959)	0.000*
	Maksila	Post OP	7	(0.48+0.3)	5	(0.424+0.128)	0.935**
		POD 30	7	(1.284+0.413)	5	(1.906+0.323)	0.018*
		UNDER 60	7	(2.314+0.76)	5	(3.598+0.468)	0.008*
		UNDER 90	7	(3.386+0.912)	5	(5.506+0.344)	0.001*

*Independent T-test; ** Mann Whitney test

Table 3 shows the results that in the tooth extraction sockets in the Mesial area at Post OP and POD 30 in the Mandibular and Maxillary regions, a p-value was obtained that was greater than $\alpha = 0.05$, which means that there was no difference between tooth extraction patients with and without PRF application. which is significant or in other words the effect of reducing the alveolar crest experienced by patients with PRF application and without PRF at Post OP and POD 30 in the Mandibular and Maxillary regions can be said to be the same. What is different is that at POD 60 and POD 90 in the mandibular and maxillary regions, the p-value was smaller than $\alpha = 0.05$, which means that in patients with tooth extraction with PRF application and without PRF there was a significant difference or in other words the effect was reduced. The alveolar crest experienced by patients with PRF application and without PRF at POD 60 and POD 90 in the mandibular and maxillary regions can be said to be different. This means that the effect of decreasing the alveolar crest begins to be different when entering POD 60 in the Mandibular and Maxillary regions, so it can be interpreted that at POD 60 in the Mandibular and Maxillary regions the effect of decreasing the alveolar crest in patients with PRF and without PRF has shown differences.

For the distal area, it was found that in the tooth extraction sockets at Post OP, POD 30, and POD 60 in the mandibular region, a p-value was obtained that was greater than $\alpha = 0.05$, which means that there were no tooth extraction patients with PRF application and without PRF. significant differences or in other words the effect of reducing the alveolar crest experienced by patients with PRF application and without PRF at Post OP, POD 30, and POD 60 in the mandibular region can be said to be the same. What is different is that

at POD 90 in the mandibular region, the p-value was smaller than $\alpha = 0.05$, which means that in patients with tooth extraction with PRF application and without PRF there was a significant difference or in other words the effect of decreasing the distal alveolar crest experienced by Patients with PRF application and without PRF at POD 90 in the mandibular region can be said to be different.

This means that the effect of decreasing the alveolar crest in the distal area begins to differ when entering POD 90 in the mandibular region, so it can be interpreted that at POD 90 in the mandibular region the effect of decreasing the alveolar crest in patients with PRF and without PRF has shown differences. Then the results of the analysis also showed that in the extraction socket in the distal area at the time of Post OP in the maxillary region, a p-value was greater than $\alpha = 0.05$, which means that in patients with tooth extraction with PRF application and without PRF there was no significant difference or with In other words, the effect of reducing the distal alveolar crest experienced by patients with PRF application and without PRF during Post OP in the maxillary region can be said to be the same.

What is different is that at POD 30, POD 60, and POD 90 in the maxillary region, the p-value was smaller than $\alpha = 0.05$, which means that in patients with tooth extraction with PRF application and without PRF there was a significant difference or in other words the effect The decrease in the distal alveolar crest experienced by patients with PRF application and without PRF at POD 30, POD 60, and POD 90 in the maxillary region can be said to be different. This means that the effect of decreasing the alveolar crest in the distal area begins to differ when entering POD 30 in the maxillary region, so it can be interpreted that at POD 30 in the maxillary region the effect of decreasing the alveolar crest in patients with PRF and without PRF is already showing differences.

Group Comparison Based on Sample Group and Time

In this section, researchers want to see a comparison of regions including the mandible and maxilla in patients. The comparisons were stratified by group and time. The test results were obtained as follows:

Table 4. Group Comparison Based on Sample Group and Time

Dental Area	**Group**	**Time**	**Mandibula**		**Maksila**		***P Value***
			n	**(Mean+SD)**	**n**	**(Mean+SD)**	
Mesial	Treatment	Post OP	11	(0.744+0.524)	7	(0.504+0.206)	0.415**
		POD 30	11	(1.694+0.598)	7	(1.423+0.434)	0.317*
		UNDER 60	11	(2.563+0.674)	7	(2.097+0.475)	0.132*
		UNDER 90	11	(3.699+0.668)	7	(3.019+0.565)	0.040*
	Control	Post OP	13	(0.436+0.28)	5	(0.516+0.219)	0.576*
		POD 30	13	(1.834+0.459)	5	(1.768+0.341)	0.776*
		UNDER 60	13	(3.159+0.635)	5	(3.382+0.319)	0.471*
		UNDER 90	13	(4.706+1.131)	5	(5.29+0.782)	0.308*
Distal	Treatment	Post OP	11	(0.581+0.525)	7	(0.48+0.3)	0.652*
		POD 30	11	(1.409+0.693)	7	(1.284+0.413)	0.674*
		UNDER 60	11	(2.282+0.811)	7	(2.314+0.76)	0.934*
		UNDER 90	11	(3.394+0.854)	7	(3.386+0.912)	0.985*
	Control	Post OP	13	(0.521+0.325)	5	(0.424+0.128)	0.533*
		POD 30	13	(1.699+0.4	5	(1.906+0.323)	0.350*

				32)			
		UNDER 60	13	(2.984+0.867)	5	(3.598+0.468)	0.157*
		UNDER 90	13	(5.007+0.959)	5	(5.506+0.344)	0.257*

Table 4 shows the results of the analysis, it was found that in the extraction of the Mesial area at Post OP, POD 30, POD 60, and POD 90 without PRF, a p-value was obtained that was greater than α=0.05, which means that the patient extracted teeth in the Mandibular and Maxillary regions. There is no significant difference or in other words the effect of decreasing the alveolar crest in the mesial area experienced by patients in the mandibular and maxillary regions at the time of Post OP, POD 30, POD 60, and POD 90 without PRF can be said to be the same. This means that the effect of decreasing the mesial alveolar crest in the mandibular and maxillary regions can be said to be the same from Post OP to POD 90 without PRF.

Then the results of the analysis also showed that in the tooth extraction socket in the Mesial area at Post OP, POD 30, and POD 60 with the PRF application, a p-value was obtained that was greater than α=0.05, which means that the patient had teeth extracted in the Mandibular and Maxillary regions. There is no significant difference or in other words the effect of reducing the mesial alveolar crest experienced by patients in the mandibular and maxillary regions during the Post OP, POD 30, and POD 60 periods with PRF application can be said to be the same. What was different was that at POD 90 with PRF application, the p-value was smaller than α=0.05, which means that patients had tooth extractions in the mandibular and maxillary regions. In the mandibular and maxillary regions, the time for POD 90 with PRF application can be said to be different. This means that the effect of decreasing the alveolar crest in the mesial area begins to be different when entering POD 90 with PRF application, so it can be interpreted that at POD 90 with PRF application the effect of decreasing the patient's alveolar crest in the mandibular and maxillary regions has shown differences.

For the distal area, the results of the analysis showed that in the extraction socket at Post OP, POD 30, POD 60, and POD 90 with PRF application and without PRF, a p-value was greater than α=0.05, which means that the patient had the tooth extracted at In the mandibular and maxillary regions, there is no significant difference, or in other words, the effect of decreasing the distal alveolar crest experienced by patients in the mandibular and maxillary regions during the Post OP, POD 30, POD 60, and POD 90 with PRF application and without PRF can be said to be the same. . This means that the effect of reducing the distal alveolar crest in the mandibular and maxillary regions can be said to be the same from Post OP to POD 90 with and without PRF application.

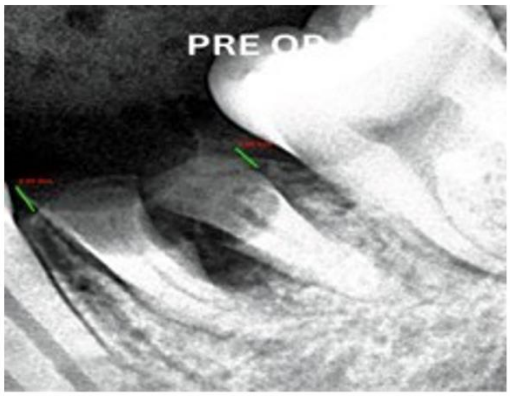

Figure 1. Post-removal socket evaluation through periapical x-ray imaging images. (top) PRF application; (bottom) Without PRF

Alveolar bone resorption is something that absolutely occurs after tooth extraction. This resorption can occur vertically or horizontally. In this study, the research subjects in table 1 were 18 (50%) people each in the treatment and control groups. In the mandibular region, 24 (66.67%) more extraction procedures were performed compared to 12 (33.33%) in the maxilla, in line with research by Sulaimani et al. in Saudi shows mandibular posterior teeth extracted in a higher percentage. This study revealed mandibular molars as the most frequently extracted teeth (60%) but maxillary lateral incisors the least frequently (0.7%). A study conducted in Scotland reported a higher percentage of premolars being extracted than molars being removed. It was concluded that lower molars were most frequently extracted (79%) while canines were extracted least frequently (1.2%). Among molars, the frequency of extraction is in the following order mandibular first molar, maxillary first molar, mandibular second molar followed by maxillary second molar. Right-sided extraction is more frequently involved. Among the anterior teeth, more maxillary teeth are removed (Sahibzada, 2016; Lin et al., 2019).

In this study, 25 (69.44%) more women underwent tooth extraction compared to 11 (30.56%) men. This is because women more often experience caries and require tooth extraction, this is in line with research by Khalil et al. which stated that the percentage of teeth extracted due to caries was 50.2%. The higher percentage of tooth extractions in women may be due to their commitment to treatment of dental problems compared with men (Sahibzada, 2016; Alesia & Khalil, 2013).

The consequence of tooth extraction is alveolar ridge resorption. The present analysis shows that the reduction of alveolar ridge dimensions after tooth extraction appears to be a natural process of physiological law. After healing of the extraction socket, the strain stimulus required to maintain bone mass is no longer achieved. Bone resorption is usually greater on the buccal aspect than on the lingual aspect. In animal and clinical studies, the vertical component of bone loss occurs more prominently on the buccal aspect (Sahibzada, 2016; Lin et al., 2019).

The consequence of greater vertical bone loss buccally than lingually is a ridge that slopes buccally-lingually. Numerous studies have shown that after tooth extraction, approximately 30% of the alveolar ridge is lost due to resorption. Studies have shown that during the first three months after extraction, approximately two-thirds of the affected hard and soft tissues experience some degree of resorption. Most bone resorption occurs during the first six months after the procedure. After that, the resorption rate increases at an average rate of 0.5-1% per year. Additionally, it is estimated that 50% of the alveolar bone width is lost in the 12 months after extraction, 30% of which occurs in the first 12 weeks. Another study showed that alveolar ridge resorption was more severe on the buccal side than the lingual side. After extraction, the lateral walls of the extraction socket undergo vigorous resorption, leading to a significant decrease in alveolar height. On average, height reduction was approximately 2 mm greater on the buccal side than on the lingual side (Sahibzada, 2016; Lin et al., 2019).

Table 2 shows that post-operatively in the mesial area POD 30 there is no significant difference, while for POD 60 and POD 90 there is a significant difference. Meanwhile, the distal post op area did not show a significant difference and POD 30, POD 60 and POD 90 showed a significant difference due to a decrease in the alveolar crest in the second and third months post extraction in the mesial and distal areas. The ridge resorption process causes the ridge to become narrow and short. Anatomically, the height of the distal mesial bone depends on the surrounding teeth. In normal teeth, Sharpey's fibers, which provide anchorage for the periosteum, protect osteoclast resorption by increasing type III collagen. Although the extraction socket does not have Sharpey's fibers, the adjacent normal tooth may dominate the surrounding bone thereby maintaining mesial and distal bone height. In this study, POD 60, the control group showed higher resorption than the PRF group. This

indicates that PRF fibrin contains a variety of bone healing cytokines that can protect growth factors from proteolysis, prolong the release of growth factors, and delay the peak of their release until day 14 (Suttapreyasri & Leepong, 2013).

The average results of alveolar bone resorption after POD 60 tooth extraction with PRF application on the mesial side were 2.382+0.634, distal side 2.294+0.769, while in the control group on the mesial side it was 3.221+0.565, distal side 3.154+0.814. This is in line with the research results of Srisurang et al. (2013) which showed that resorption of the lingual buccal marginal ridge after eight weeks post-extraction in the PRF group (1.96+1.10, 1.59+0.64 mm) was lower than the control group (2.59+0.70, 1.78+0.47 mm) (Suttapreyasri & Leepong, 2013). The average result of alveolar bone resorption after POD 90 tooth extraction without PRF application on the mesial side was 4.868+1.058 mm and on the distal side it was 5.146+0.854. This is the same as research conducted by Lasella et al. (2003) who measured changes in bone dimensions after tooth extraction in the buccal/lingual and mesial/distal directions found that the average change in bone dimensions in the mesial direction was 2.7 mm and distally 2.6 mm.

The same research was also conducted by Serino et al. (2003) in measurements six months after tooth extraction there was bone resorption of 1.6 mm on the buccal side, and 1.2 mm distally. This research is also in line with research conducted by Barone et al. (2008) who found that the average resorption after tooth extraction on the mesial side was 1.6 mm and on the distal side was 1.5 mm.

This study measured the height of the cementoenamel junction (CEJ) distance to the mesial and distal alveolar remnants in both groups using plain radiography, the taking of which can be influenced by the angle of taking the photo. In this study, a periapical digital holder was used to minimize the risk of bias. Periapical radiography reveals only a limited aspect (two-dimensional view) of the true three-dimensional anatomy. Because of these limitations of plain radiography, cone-beam computed tomography (CBCT) is recommended for smooth image measurements, if available. However, CBCT radiation dose is higher and more expensive than periapical radiography (Taravati et al., 2022).

In table 3, it shows that after surgery in the mesial region of the mandible and maxilla, the PRF and control groups on POD 30 did not show significant differences, while for POD 60 and POD 90 showed significant differences. Meanwhile, in the distal mandibular region, the PRF and control groups on POD 30 and POD 60 did not show significant differences, while for POD 90 they showed significant differences. In contrast to the results found in the distal maxillary region of the PRF and control groups on POD 30, they showed a significant difference in crest reduction in the post-extraction socket. The maxillary and mandibular bones are complex bones, which are composed of several anatomical structures with precise functions. The maxillary and mandibular bones are composed of: (1) basal bone, which develops together with the overall bone framework to form the mandible and maxilla; (2) the alveolar bony ridge, which develops with tooth eruption, containing the dental alveolus; (3) The bone bundle, which lines the alveolar socket, extends coronally, forming the buccal crest, and forms part of the periodontal structure, surrounding the external part of the periodontal fibers (Sharpey's fibers). After a tooth is extracted, the bone bundle is the first part of the bone to be absorbed, followed by the alveolar bone gradually. The results of the remodeling process result in a reduction in ridge morphology in the vertical plane. After one year of tooth extraction, the reduction in residual ridge height in the midsagittal plane averaged 2-3 mm in the maxilla and 4-5 mm in the mandible. The magnitude of residual ridge reduction varies greatly depending on systemic conditions, local bone resorption factors, and is inversely proportional to certain local bone formation factors (Hutchinson et al., 2015; Liebschner, 2004).

In table 4, it shows that the extraction socket in the distal area did not show significant results in reducing the alveolar crest in the mandibular and maxillary regions from Post OP

to POD 90 in the PRF and control groups. Meanwhile, the mesial area at POD 90 in the PRF group in the Mandibular and Maxillary regions showed significant results in reducing the alveolar crest, which means that PRF worked to prevent lowering of the alveolar crest in the mesial area of the maxillary and mandibular regions. This is in line with research conducted by Hauser et al. who measured two-dimensional marginal bone resorption after two months and showed statistically significant differences, especially in the mesial part. Evaluation of bone density using radiography was also carried out by Adnan et al., with the highest bone density results in the PRF group reaching 95% at week 12 (Hauser et al., 2013; Adnan et al., 2023).

After tooth extraction, bone formation usually takes 16 weeks. For this reason, a mechanism is needed that can speed up the wound healing process. Much effort has been focused on wound care with emphasis on new therapeutic approaches and technological development for the management of acute and chronic wounds. Wound healing involves multiple cell populations, the extracellular matrix and the action of mediators such as growth factors and cytokines. To speed up the wound healing process, optimal treatment techniques and procedures are needed by utilizing various factors involved in the wound healing process. Healing of hard and soft tissues is mediated by a variety of intracellular and extracellular events regulated by protein signals. Bones have a limited ability to self-repair and regenerate tissue, making it a problem in the world of health. One of the therapeutic efforts to regenerate periodontal tissue and alveolar bone is through tissue engineering. The three basic components in tissue engineering are (1) progenitor cells, (2) a scaffold system as the initial extracellular matrix needed for cell proliferation, migration and differentiation, and (3) growth factors (Damayanti & Yuniarti, 2016; Bianco & Robey, 2001).

Apart from playing a role in the hemostasis process, platelets are also a source of various growth factors which play an important role in the wound healing process, acute tissue responses to trauma, and are involved in several cellular physiological processes, for example growth, differentiation and cell replication. Platelets are involved in the wound healing process through the formation of blood clots and releasing growth factors that enhance and accelerate wound healing. Platelet concentrate which is rich in growth factors is found in Platelet-Rich Fibrin (PRF). Research conducted by Baeyens W. et al. utilizes PRF which is a fibrin matrix where cytokines, platelets containing growth factors, and trapped cells can be removed after a certain time which can function as a resorbable membrane. Choukroun et al., were pioneers in using PRF in oral and maxillofacial surgery to improve bone healing in dental implants. Autologous PRF is considered a healing biomaterial, which has been widely developed in various dental disciplines (Damayanti & Yuniarti, 2016; Ten Heggeler et al., 2011).

This study shows significant results in bone resorption, namely reduction of the alveolar crest in the post-extraction socket with PRF application, with the risk of cross-infection which can be avoided because it is autologous from the patient, so the use of PRF can be considered as an additional procedure of choice in dental extraction procedures.

Conclusion

This study concluded that there was a significant difference in the reduction of the alveolar crest in the post-extraction socket with PRF application on POD 90 as evaluated radiographically. There were no significant results in reducing the alveolar crest in the post-extraction socket in the maxilla and mandible with PRF application compared to the group without PRF.

Research Ethics Permit

This research has been submitted to the Research Ethics Committee of the Faculty of Dentistry, Hasanuddin University under No. 0109/PL.09/KEPK FKG-RSGM UNHAS/ 2022.

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