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Effect on Injectable Platelet Rich Fibrin in Augmentation of Thin Gingival Biotype: A Clinical Trial

Vaibhav Tiwari
Department of Periodontology and Implantology, Government Dental College, Raipur, India

Sangita Agarwal
Department of Periodontology and Implantology, Government Dental College, Raipur, India

Varsh Goswami
Department of Periodontology and Implantology, Government Dental College, Raipur, India

Bharat Gupta
Department of Periodontology, Mgm Dental College, Navi Mumbai, India

Nupoor Khiraiya
Department of Periodontology and Implantology, Government Dental College, Raipur, India

Varsha Rani Soni
Department of Periodontology and Implantology, Government Dental College, Raipur, India

***Abstract*---**Aim: This study is an attempt to evaluate the effect of i-PRF on thin gingival biotype. Methodology – For this study, systemically healthy patients were enrolled. 13 sites with thin periodontal phenotypes were selected and injected with i-PRF at baseline, 1 week and 2 week using microneedle. Clinical periodontal measurements, including GT and KTW were assessed at baseline, one month and three months after the final injections. Results- At baseline mean GT and KTW were 0.65 and 3.76 respectively. At one month and three months follow up, there was statistically significant difference seen in GT and KTW. Mean GT increased to 0.96mm and 1.0 mm at 1month and 3months respectively. Conclusion - The

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***Corresponding author**: Tiwari, V.; Email: cybervt1@yahoo.co.in*
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results suggest that application of i-PRF can be non-surgical approach for increasing gingival thickness.

***Keywords*---**augmentation, fibrin, gingival biotype, injectable platelet, microneedle.

Introduction

Among the factors that may impede success in dental treatments, gingival biotype is the greatest cause of concern, particularly affecting the outcomes of periodontal therapy, root coverage procedures, and implant placement. According to Muller & Eger (2002), gingival phenotype refers to gingival thickness (GT) and keratinized tissue width (KTW) (Müller et al., 2007). It has been observed that patients with thin gingival biotype were more likely to experience gingival recession following nonsurgical periodontal therapy (Claffey & Shanley, 1986). Literature suggest that with flap surgery and regenerative procedures, there is at least 0.5– 0.8 mm of bone loss which is unavoidable and can lead to gingival recession following surgery. Limited gingival recession has been observed in thick biotypes than in thin biotypes, taking this into consideration and to achieve a predictable outcome with all periodontal procedures a flap thickness of 0.8–1.2 mm is recommended.3 Several surgical techniques had been performed for the treatment of gingival recession.

Platelet-rich fibrin (PRF) was therefore developed as a second-generation autologous platelet concentrate without the use of anticoagulants or other additives, which was first termed (Choukroun et al., 2000). The main advantages of platelet- rich fibrin which had been documented include the fact that it contains host immune defense cells & tissue-wound healing (Choukroun et al., 2006). In 2014, a liquid injectable-platelet-rich fibrin (i-PRF) was developed by modifying spin centrifugation forces (Varela et al., 2019). At lower centrifugation speeds and by utilizing non-glass centrifugation tubes, the fibrin coagulation could be slowed down at early time points thus generating an injectable- PRF (Choukroun & Ghanaati, 2018). Much like traditional PRF, i-PRF contains an increase in leukocyte number and is further able to stimulate growth factor release (Mourão et al., 2015). There is similarity between platelet-rich fibrin and injectable- PRF regarding tissue regeneration and less invasive to tissue. Therefore, this is an attempt to increase gingival thickness and keratinized tissue width on thin gingival biotype using microneedle.

Material and Method

An interventional study with three months follow-up was approved by the Ethical Committee, Government Dental College, Raipur. Participants were informed about the procedure and written consent was obtained. Systemically healthy individuals of age 20-40 years with absence of periodontal disease who was having thin gingival biotype (<1.5mm) were included in this study. Noncompliant patients, smokers, pregnant and lactating women were excluded from this study.

Clinical measurements

The Clinical parameters includes:

- Plaque index (PI) Löe & Silness (1963), Gingival index (GI) ,Gingival thickness (GT) Zucchelli et al. (2010), Keratinized tissue width (KTW) Fotani et al. (2019)
- The parameters were measured at baseline, one month & three months after the final injections.

The method to be used for evaluation of gingival thickness including probe transparency method and direct measurement. In a probe transparency method, UNC- 15 probe placed into the gingival sulcus, if it is visible through gingival sulcus, then gingival biotype is classified as thin and when periodontal probe is not visible through gingival sulcus then it is thick gingival biotype (Zucchelli et al., 2010). (Figure 1)

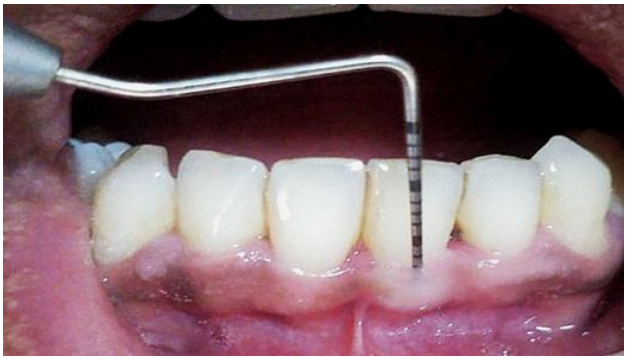


Figure 1. Gingival sulcus

For direct measurement of gingival thickness, the site was anaesthetized with Lidocaine 10% spray and a reamer (25 number) was inserted perpendicularly from thevestibular midpoint at 1.5 mm apical of the gingival margin, through the soft tissues until a hard surface was felt, stopper was used as the reference point and the exact measurement was recorded with the help of digital vernier caliper with stopper (Zucchelli et al., 2010). (Figure 2)

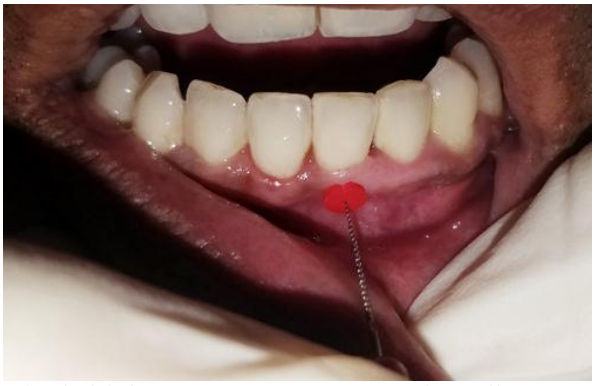


Figure 2. Gingival thickness = Measurement in caliper – Stopper width

Keratinized tissue width was measured from gingival margin to mucogingival junction with the help of calibrated periodontal probe (UNC 15 probe) (Fotani et al., 2019).

Preparation and administration of i-PRF[12]

After collection of 5 ml of peripheral blood from each subject, blood was transferred to a vial tube without anticoagulant. Then this tube immediately centrifugedat 3300 rpm for 2 mins (Anderegg et al., 1995). After centrifugation, two fluid layers was formed, upper being yellowish golden fluid layer (i-PRF) while lower layer containing red blood cells. (Figure 3) Yellowish golden fluid layer containing i-PRF immediately aspirated using microneedle. The selected site was cleaned and anaesthetized with local anesthesia. i-PRF was injected at the selected siteinto the gingival sulcus using microneedle. i-PRF again injected at the same site after 1 week and after 2 weeks, from the baseline final i-PRF injection was given. (Figure 4)

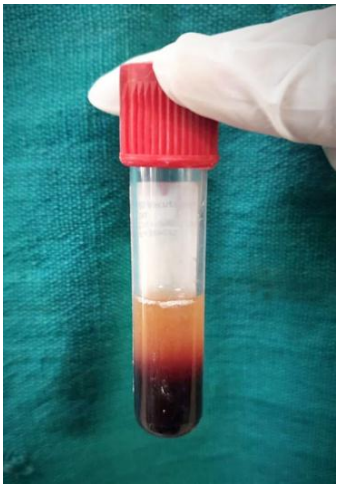


Figure 3. Two fluid layers was formed, upper being yellowish golden fluid layer (i-PRF) while lower layer containing red blood cells

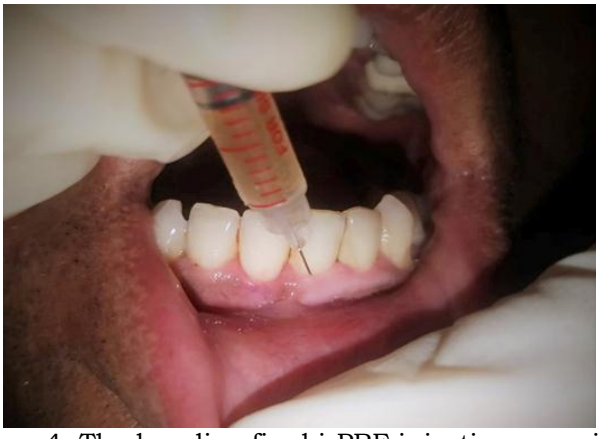


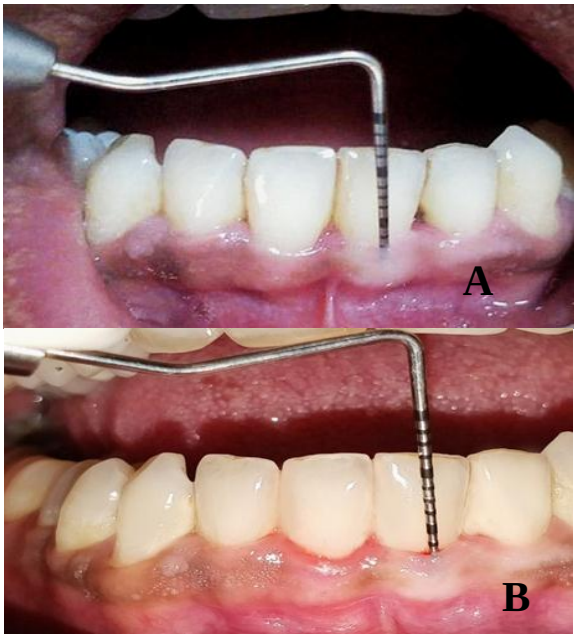
Figure 4. The baseline final i-PRF injection was given

Statistical analysis

All statistical analyses were conducted using software SPSS. All parameters were assessed by one way ANOVA test. Intragroup comparison from baseline to 1month and 3 months was followed by **Post hoc test** and p-value ≤ 0.05 was considered statistically significant.

Results

The clinical parameters including gingival thickness, keratinized tissue width, plaque index and gingival index recorded at baseline, first monthand third months are shown in Table 1. The mean plaque index at baseline, first month and third months was 1.76, 1.61 and 1.46 respectively. The mean gingival index at baseline, one month and three months was 1.46, 1.30 and 1.15 respectively. The results of the indices were not found to be statistically significant. The mean gingival thickness at baseline was 0.65 which was increased to 0.96 after 1 month and 1.00 after 3 months (Table 1). A statistically increment was observed in gingival thickness. The mean keratinized tissue width at baseline was 3.76. After a month and third month follow up, the mean keratinized tissue width found to be increased i.e., 4.53 and 4.69 respectively (Table 1) (Figure 5).



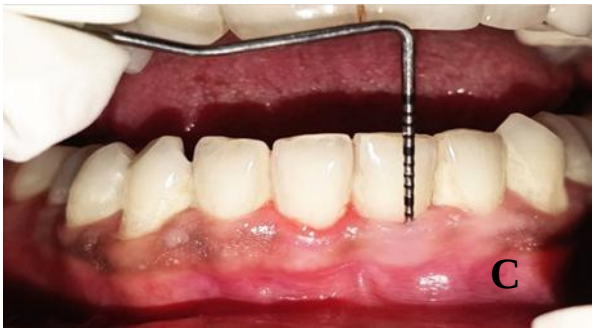


Figure 5. A statistically increment was observed in gingival thickness

Table 1
The mean keratinized tissue width

		N	Mean	P-value
GI	Baseline	13	1.4615±.51887	.250
	1 month	13	1.3077±.48038	
			1.1538±.37553	
	3 months	13		
			1.3077±.46757	
	Total	39		
			1.7692±.59914	
PI	Baseline	13		.363
			1.6154±.50637	
	1 month	13		
			1.4615±.51887	
	3 months	13		
			1.6154±.54364	
	Total	39		
			.6538±.20662	
GiT	Baseline	13		.001*
			.9615±.10439	
	1 month	13		
			1.0000±.09129	
	3 months	13		
			.8718±.21020	
	Total	39		
			3.7692±.59914	
KTW	Baseline	13		.001*
			4.5385±.51887	
	1 month	13		
			4.6923±.48038	
	3 months	13		
			4.3333±.66227	
	Total	39		

Figure 6 shows plaque index, gingival index gingival thickness and keratinized tissue, are recorded at baseline, first month and third months. The graph shows increased gingival thickness and keratinized tissue width at first month and third months from baseline. There is decrease in the values of plaque index and gingival index as compared to baseline data with no significant results.

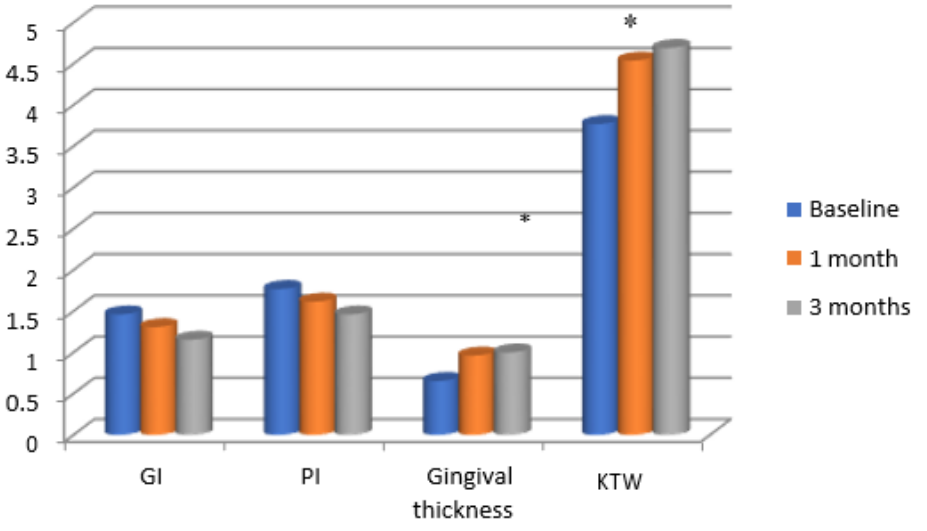


Figure 6. Clinical parameters including GI, PI, GT, KTW were recorded at baseline one month and three months.
*Denotes were statistically significant ($p<0.05$)

Discussion

Therapeutic spectrum in periodontics has expanded considerably in regenerative and plastic periodontal surgery. Gingival biotype has become the subject interest as thickness of gingiva plays an important role in development of gingival recession Baldi et al. (1999), wound healing Anderegg et al. (1995), and flap management during regenerative surgical procedures13, and also a significant predictor of the clinical outcome of root coverage procedures (Baldi et al., 1999). The innovative advancement in the field of platelet concentrates such as vast benefits of PRF for the treatment of various types of periodontal diseases. One of the latest developments in the PRF technology is the production of injectable PRF (i-PRF) with the added advantage of being in the injectable form. The present study evaluated the role of injectable platelet rich fibrin on subjects with thin gingival biotype.

i-PRF forms a dynamic fibrin gel, rich in platelets and leukocytes, acting as a scaffold for wound healing (Varela et al., 2019). The three-dimensional fibrin matrix also plays a important role in tissue repair. Fibrin acts as a scaffolding biological material for agglomeration of adherent cells at the site of tissue healing. Additionally, fibrin is a carrier of growth factors in a well-controlled release system that sustains proper bioactivity over the healing period (Janmey et al.,

2009; Kobayashi et al., 2012). i-PRF releases growth factors which will accelerate neoangiogenesis and neocollogenesis more remarkably. According to Wang et al. (2017) i-PRF can induce higher cell migration. Injectable PRF showed higher messenger RNA levels of PDGF, TGF- β, type I collagen and fibronectin than PRP. The authors concluded that i-PRF found to be an effective role & can be formulated without any anticoagulants.

Karde et al. (2017) assessed the antimicrobial characteristics and platelet count of i-PRF as compared to other PRF, PRP and whole blood. Collection of blood samples were carried from chronic generalized marginal gingivitis individuals. Further antimicrobial activity against oral bacteria was investigated on blood agar using disc diffusion method to evaluate the inhibitory effects. The authors observed that i- PRF has a significant role in the inhibition of oral bacteria growth as compared to other platelet concentrates (Karde et al., 2017). Fotani et al. (2019), assessed the role of i-PRF in thin gingival tissue and stated that the use of i-PRF through microneedle is less invasive and achieved better results in increasing gingival thickness. In another study Ozsagir et al. (2020), evaluated the efficacy of injectable platelet-rich fibrin alone and in combination with microneedling (MN) on gingival thickness (GT) and keratinized tissue width (KTW) in patients with thin biotype. They stated that microneedling has a beneficial result on the augmentation of Gingival thickness. In the current study, 13 subjects were included & i-PRF was done with microneedle at baseline, 1 week and 2 weeks. Results shows that gingival thickness and keratinized tissue width were significantly higher at first month and third month compared to baseline levels, confirming previous studies.

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