COMPARATIVE EVALUATION OF THE EFFICACY OF PRF WITH AND WITHOUT LOW-LEVEL LASER THERAPY IN THE TREATMENT OF INTRA-BONY DEFECTS: A CLINICO-RADIOGRAPHIC STUDY

DISSERTATION

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IN

PERIODONTOLOGY

BY

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Declaration By The Candidate

I hereby declare that this dissertation entitled "**Comparative evaluation of the efficacy of PRF with and without low-level laser therapy in the treatment of intra-bony defects: A clinico-radiographic study**" is a bonafide and genuine research work carried out by me under the guidance **Dr. Suraj Pandey**, Reader, Babu Banarasi Das University, Lucknow, Uttar Pradesh.

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DEDICATED TO

MY PARENTS

AND

MY SISTER

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LIST OF ABBREVIATIONS

PRF	Platelet Rich Fibrin
PPD	Pocket Probing Depth
CAL	Clinical Attachment Level
LLLT	Low Level Laser Therapy
OFD	Open Flap Debridement
RVG	Radiovisiography
IOPAR	Intraoral Periapical Radiograph
RBF	Radiographic Bone Fill
PI	Plaque Index
GI	Gingival Index
RBC	Red Blood Cell
CALG	Clinical Attachment Level Gain
LASER	Light Amplification by the Stimulated Emitted of Radiation

Abstract

Objective: To assess and compare the clinical parameters such as Plaque index, Gingival index, probing pocket depth (PPD), Clinical attachment level (CAL) determined bone level radiographically in test group (OFD+PRF+LLLT) and the control group (OFD+PRF) at baseline, 3months & 6 months post operatively.

Materials and Methodology: 20 patients fulfilling the inclusion and exclusion criteria were randomly divided into the Control Group having patients undergoing open flap debridement with PRF placement at the area of intrabony defect and test group with patients undergoing open flap debridement along with biomodulation using LLLT and PRF placement at the site of defect. The clinical and radiographic parameters were then compared such as Plaque index, Gingival index, Probing pocket depth (PPD), Clinical attachment level (CAL) and to determine the bone level radiographically in test group (OFD+PRF+LLLT) and the control group (OFD+PRF) at baseline, 3months & 6 months post operatively.

Result: The intragroup comparison in both the groups showed consistently significant improvement in all clinical and radiographic parameters at 6 months post surgically. Compared to baseline the mean PPD at 3 and 6months were 4.35±0.74 and 4.35±0.81 in the control group and 5.60±2.83 and 5.35±0.26 in the test group respectively. The CALG in the test and control group were reported 2.25±0.63 and 3.30±2.79 respectively 6 months post operatively. Significant bone gain was seen in the control and test group 6 months postoperatively as 1.90±1.28 and 3.15±1.49 respectively.

Conclusion: The study concludes that both the groups, test (OFD+LASER+PRF) as well as control (OFD+PRF) showed an overall improvement in the clinical and radiographic parameters accessed in the study. Better results were reported in the control group when compared to the test group. However, the difference between both the groups is statically non-significant.

Periodontitis is a multifactorial chronic inflammatory disease defined by breakdown of the periodontal soft and hard tissues. Impaired balance between the subgingival microbiome and the immune system, modified by lifestyle, genetic and systemic health factors, leads to the development of the disease.[1]Periodontal diseases comprises a group of inflammatory conditions of the supportive tissues of the tooth such the gingiva, periodontal ligaments, cementum and the bone. The irreversible loss of connective tissue attachment and supporting alveolar bone leads to disruption in the equilibrium of the homeostasis which further results into alteration of bone remodelling. Intrabony defects are the hallmark for apical spread of periodontitis. In 2017, few authors reported about the existence of three periodontitis phenotypes (cluster A, cluster B and cluster C) based on intake radiographic (mean number of teeth with different percentages of bone loss and angular defects) and microbiological information (culture, 7 bacteria) from 392 untreated patients. In addition, they noted that a number of periodontitis patients (10% of the cohort) did not fit in any of the three main clusters. Cluster A comprised mainly of young individuals with a more localized disease pattern and a high prevalence and high proportions of Aggregatibacter actinomycetemcomitans (Aa). The other two clusters did not differ in microbiological composition, but they presented distinct disease severity and smoking habits. Specifically, cluster C was characterized by the most severe alveolar bone loss (ABL) and the highest percentage of current smokers.[2]

Classically, periodontal defects have been classified based on bone resorption patterns as supra-osseous or suprabony and infra-osseous or infrabony.[3] These authors defined suprabony defects as those where the base of the pocket is located coronal to the alveolar crest. On the other hand, infrabony defects are those with apical location of the base of the pocket relative to the bone crest. Goldman and Cohen(1984) then classified infrabony defects according to the location and number of osseous walls remaining around the pocket. It has been suggested that the term ‘intrabony’ means ‘within or inside the bone’, while ‘infrabony’ means ‘below the crest of bone’.[4] The primary goal of periodontal therapy is to maintain the natural dentition in healthy and functional condition. Periodontal disease is the primary cause of

loss of the periodontal apparatus and requires regenerative procedures for the repair and regeneration of the periodontium.

The American Academy of Periodontology has defined regeneration as the reproduction or reconstitution of a lost or injured part to restore the architecture and function of the lost or injured tissues. Periodontal regeneration is defined as regeneration of the tooth-supporting tissues including cementum, periodontal ligament and alveolar bone.[5] The use of platelets for regenerative procedures in periodontal therapy has attenuated in recent years. Platelets, which contain growth factors, play major roles in cell migration, proliferation, differentiation and angiogenesis and are associated with the tissue regeneration process.[6]

While platelet-rich plasma (PRP) was proposed as a first-generation platelet concentrate, the use of anticoagulants has since been shown to interfere with the angiogenic and regenerative responses mediated by platelets.[7] For these reasons, a second-generation platelet concentrate, termed platelet-rich fibrin (PRF), has more been introduced in regenerative medicine and dentistry.[8-12] These are the 3 keys to healing and soft tissue maturation(Choukroun et al. 2006). The membranes of PRF are able to simultaneously support the development of 3 basic phenomena which accelerates wound healing and tissue regeneration. The angiogenesis property of fibrin matrix[46] is explained by the 3-dimentional structure of the fibrin gel and by the simultaneous action of cytokines trapped in the meshes. Furthermore, main angiogenesis soluble factors such as fibroblast growth factorebasic (FGFb), vascular endothelial growth factor (VEGF), angiopoı¨etin and platelet-derived growth factor (PDGF) are included in fibrin gel. Some studies8,9 indicate that FGFb and PDGF can bind to fibrin with high affinity. Therefore, direct fibrin angiogenesis induction could be explained by fibrin binding of numerous different growth factors.[35] Fibrin and fibrinogen degradation products (FDP) stimulate the migration of neutrophil and increase the membrane's expression of CD11c/CD18 receptor. This receptor permits adhesion of the neutrophil to endothelium and fibrinogen as well as the transmigration of neutrophils.[47] Fibrin and wound coverage Fibrin matrix guides the coverage ofinjured tissues, affecting the metabolism of epithelial cells and fibroblasts. Around

the wound's margins, epithelial cells lose their basal and apical polarity and produce basal and lateral extensions toward the wound side. The cells subsequently migrate on the transitory matrix made by fibrinogen, fibronectin, tenascin, and vitronectin. This migration is more like a genuine matrix degradation than a simple translation.[35]

Laser technology, specifically the diode laser has gained popularity in periodontics with benefits. They have also provided evidence as effective alternative to simultaneously remove the diseased soft tissues, target the micro-organisms as well as stimulate wound healing. Laser use produces less postoperative swelling, reduces inflammation and is also relatively painless. Several clinical studies have supported the antibacterial effect of lasers in periodontal pockets.[13-16] Some studies have even reported tissue regeneration on histologic evaluation following laser mediated periodontal therapy utilizing the "laser assisted new attachment procedure."[17-18] Furthermore, several authors have reported enhanced outcomes using lasers to de-epithelize the inner lining of the flap based on the principle of guided tissue regeneration.[19-21] LLLs do not incise the tissues and are also known as a therapeutic laser or cold laser. Low level laser therapy has been shown to increase the proliferation of undifferentiated mesenchymal cells and attenuate the upregulation of growth factors at the site of regeneration. Low-level lasers further initiate sequence of events such as signalling to increase cellular proliferation. Low level laser therapy also enhances the viability of osteoblasts through an osteogenic bio-stimulatory effect on osteoblast-like cells, thus promoting linear bone growth, thereby improving the regenerative potential of the periodontal osseous defect.[22,23]

Thus, aim of the present study is to compare the possible outcomes in relation to clinical and radiographical parameters in the two groups of patients with intrabony defects; the first group undergoing open flap debridement along with PRF placement and second group undergoing open flap debridement along with PRF placement with low level laser therapy as an adjunct.

AIM

The aim of the study is to compare the possible outcome in relation to clinical and radiographical parameters in the two groups of patients with intrabony defects: the first group undergoing PRF and second group undergoing PRF with low level laser therapy as an adjunct.

OBJECTIVES

1. To assess and compare the clinical parameters: - Plaque index, Gingival index, Probing pocket depth (PPD), Clinical attachment level (CAL) at baseline, 3months & 6 months post operatively.

2. To determine the bone level radiographically at baseline, 3 months & 6 months post operatively.

Prichard J.F. (1967)[27] reviewed an article on the etiology, diagnosis and treatment of the intrabony defect. They discussed about the classification and types of intrabony defect. They summarised the article by stating bony defects can usually be classified by their morphology as intrabony, hemisepta, craters, inconsistent margins, and furcae invasions. The type of defect that forms depend on the anatomy of the dental arch and the nature and severity of the irritant causing the disease. Bizarre forms occur where the bony arch is unusually wide. Knowledge of all bony defects occurring in periodontal disease is necessary for diagnosis and management of intrabony defects. They further concluded that the treatment of the intrabony defect consists of debridement of the bony crypt, removal of accretions if present on the root, relief of occlusion if the tooth is loose, antimicrobial medication, and protection of the wound.

Rosen P.S., Reynolds M.A. & Bowers G.M. (2000)[24] published an article which reviewed various technique for the successful use of bone grafts and to review the literature on graft materials, citing evidence where regenerative potential exists. The article contained substantial clinical and histological evidence that support the concept that extraoral and intraoral autogenous bone grafts and demineralized freeze-dried bone allografts are effective regenerative materials in the treatment of intrabony defect. They further concluded that synthetic grafts may result in improved probing depths and clinical attachment levels but have yet to demonstrate the ability to initiate or enhance the formation of a new attachment apparatus.

Cortellini P. & Tonetti M.S. (2000)[25] reviewed an article with the aim to evaluate the efficacy of regenerative procedures to displace the epithelial attachment at a more coronal position than before treatment, allowing cells from periodontal ligament and bone to repopulate the root surface and to form a new periodontal attachment. They discussed the concept of GBR in detail with the benefit from the use of barrier membranes in the treatment of

intrabony defects. They further concluded that the clinical outcomes, in terms of gain of periodontal support, pocket depth reduction and minimal recession of the gingival margin, are influenced by a series of factors that can be controlled.

Rossmann J.A. (2001)[21] prepared a report about the use of lasers in dentistry which has generated considerable interest in both professional and lay audiences. The purpose of this report was to provide information for members of the dental profession about the current and potential application of laser technology to periodontal practice. The decision to use a laser for periodontal surgery should be based on the proven benefits of hemostasias keeping in mind the claimed (but undocumented) advantage of less postoperative pain with gingivectomy, frenectomy, or other procedures. Further peer reviewed, comparative clinical studies are required to establish the potential of lasers in periodontal therapy. This is particularly true for subgingival applications, e.g., root debridement, soft tissue curettage, and excisional new attachment. Furthermore, no long-term clinical studies have shown that laser therapy alone can effectively be used to treat adult chronic periodontitis. The public and general dental practitioners should realize that FDA safety clearance for laser treatments, consisting primarily of soft tissue removal, do not routinely apply to the treatment of most periodontal diseases.

Cortellini P. & Tonetti M.S.(2003)[25] published an article with an objective to determine the efficacy of the sinus augmentation procedure and compare the results achieved by various surgical techniques , grafting materials and implants. The authors followed data on MEDLINE, the Cochrane oral health group specialised trials register. They found out the following data : forty-three studies, 3 randomized controlled clinical trials (RCTs), 5 controlled trials (CTs), 12 case series (CS), and 23 retrospective analyses (RA) were identified. Implant survival rates were higher when a membrane was placed over the lateral window, the utilization of grafts consisting of 100% autogenous bone or the inclusion of autogenous bone as a component of a

composite graft did not affect implant survival, there was no statistical difference between the covariates of simultaneous versus delayed implant placement, types of rough-surfaced implants, length of follow-up, year of publication, and the evidence level of the study.

American Academy of Periodontology – Research, Science and Therapy Committee (2004)[36] prepared a paper and intended for the information of the dental profession. It represented the position of the Academy regarding the current state of knowledge about treatment of plaque-induced gingivitis, chronic periodontitis, and some other clinical conditions. Two other papers entitled The Pathogenesis of Periodontal Diseases and Diagnosis of Periodontal Diseases also reflect the Academy's position on these subjects.They concluded inflammatory components of plaque induced gingivitis and chronic periodontitis can be managed effectively for the majority of patients with a plaque control program and nonsurgical and/or surgical root debridement coupled with continued periodontal maintenance procedures. Some patients may need additional therapeutic procedures. All of the therapeutic modalities reviewed in this position paper may be utilized by the clinician at various times over the long-term management of the patient's periodontal condition.

Stein A., Benayahu D., Maltz L., and Oron U. (2005)[33] conducted a study with the aim to investigate the effect of low-level laser irradiation on proliferation and differentiation of a human osteoblast cell line. It was previously found that low-level laser therapy (LLLT) enhances bone repair in experimental models. Materials and methods: Cultured osteoblast cells were irradiated using He-Ne laser irradiation (632 nm; 10 mW power output). On the second and third day after seeding the osteoblasts were exposed to laser irradiation. The effect of irradiation on osteoblast proliferation was quantified by cell count and colorimetric MTT (dimethylthiazol tetrazolium bromide) assay 24 and 48 h after second irradiation. A significant 31–58% increase in cell survival (MTT assay) and higher cell count in the once-

irradiated as compared to nonirradiated cells was monitored. Differentiation and maturation of the cells was followed by osteogenic markers: alkaline phosphatase (ALP), osteopontin (OP), and bone sialoprotein (BSP). A two-fold enhancement of ALP activity and expression of OP and BSP was much higher in the irradiated cells as compared to non-irradiated osteoblasts. They concluded that LLLT promotes proliferation and maturation of human osteoblasts in vitro. These results may have clinical implications.

Choukroun J., Girard M.O., Dohan S.L.,d Anthony J. J. Dohan,e Jaafar Mouhyi (2006)[37] prepared an article in which the author's investigation is made into the previously evaluated biology of PRF with the first established clinical results, to determine the potential fields of application for this biomaterial. The reasoning was structured around 4 fundamental events of cicatrisation, namely, angiogenesis, immune control, circulating stem cells trapping, and wound-covering epithelialization. All the known clinical applications of PRF highlight an accelerated tissue cicatrisation due to the development of effective neovascularization, accelerated wound closing with fast cicatricial tissue remodelling, and nearly total absence of infectious events. This initial research therefore makes it possible to plan several future PRF applications, including plastic and bone surgery, provided that the real effects are evaluated both impartially and rigorously. They further stated that the clinical experience confirms that PRF can be considered as a healing biomaterial. It features all the necessary parameters permitting optimal healing. These consist of a fibrin matrix polymerized in a tetramolecular structure, the incorporation of platelets, leukocyte, and cytokines, and the presence of circulating stem cells. Even though cytokines trapped in PRF are gradually released and able to accelerate the cellular phenomenon, the structure of the fibrin network is the key element of all improved PRF healing processes.

Bains V.K. , Gupta S., Bains R. (2010)[30] highlighted facts about commonly used lasers in dentistry viz CO2 , Nd:YAG, Ho:YAG, Er: YAG, Er,Cr:YSGG,

Nd:YAP, GaAs (diode) and argon, Er:YAG laser, at appropriate settings, possesses the best property for selective subgingival calculus removal without a thermal change of the root surface, soft tissue surgical procedures, root surface alterations, degranulation and implant surface decontamination alongwith proposed application in osseous surgery. They further concluded Lasers have been suggested as an adjunctive or alternative to conventional techniques for various periodontal procedures and considered superior in respect to easy ablation, decontamination, and hemostasis alongwith less operative and post-operative pain. Introduction of lasers in implant therapy and newer laser technical modalities has revolutionised the periodontal treatment outcome with patient acceptance. However, pateint risk and procedural cost must always be considered and fully understood before its application.

Saluja H., Dehane V., Mahindra U. (2011)[38] reported the potential use and benefits of Platelet-Rich Fibrin (PRF) over Platelet-Rich Plasma (PRP), for wound healing post oral and maxillofacial surgeries. The article described the evolution of the second-generation platelet concentrate and its multiple uses in various surgical procedures. Around 5 ml of whole venous blood is collected from the patients in each of the two sterile vacutainer tubes of 6 ml capacity without anticoagulant. The vacutainer tubes are then placed in a centrifugal machine at 3000 revolutions per minute (rpm) for 10 minutes, and the middle fraction containing the fi brin clot is then collected 2 mm below lower dividing line, to obtain the PRF. However, the preparation being strictly autologous, the amount of PRF obtained is limited.

Elavarasu S., Naveen D., Thangavelu A. (2012)[31] reviewed an article and stated that with conventional mechanical instruments, complete access and disinfection may not be achieved during the treatment of periodontal pockets. Lasers have the potential advantages of bactericidal effect, detoxification effect, and removal of the epithelium lining and granulation tissue, which are

desirable properties for the treatment of periodontal pockets. Therefore, they concluded that the laser systems, applying the ablation effect of light energy which is completely different from conventional mechanical debridement, may emerge as a new technical modality for periodontal therapy in the near future.

McGuire J.L. (2013)[39] published an article with the purpose to determine if Accell connexus, a demineralized freeze/dried bone allograft product that contains 5/7 times the amount of bone morphogenetic proteins as regular demineralized freeze/dried bone allograft (DFDBA) provides superior periodontal regeneration (formation of new bone, cementum, and connective tissue around teeth) than regular demineralized freeze/dried bone allograft. At present since no data has been analysed, they couldnot draw any conclusions or make any statements regarding the efficacy of the material. Thirty patients diagnosed with severe periodontitis, having at least one intrabony defect with a probing depth > 6mm, were enrolled. Participants had impressions made of their upper and lower teeth to provide dental stone models of the maxillary and mandibular arches. Customized plastic stents were fabricated on the models were used by blinded investigators to obtain standardized clinical measurements of the defects before surgery and at 6 and 12 months after surgery. They concluded based upon clinical experience using the material Accell connexus, we predict the Accell connexus\ will show improved bone fill and clinical attachment levels compared to demineralized freeze/dried bone allograft.

Passanezi E., Damante C.R., Rezende M.R. & Aguiar G.S.(2014)[32] reviewed an article in which Latin-American authors have spent considerable efforts to elucidate the biological effects of highland low-intensity lasers, used alone or in association with photosensitizing agents. Although the use of lasers in periodontics and dental implants has demonstrated promising outcomes in vitro, the results are still conflicting and difficult to extrapolate

to clinical practice. Induction of growth factors is one of the cellular effects produced by laser irradiation that explains the acceleration of wound healing. The effects on root dentin, either in the removal of smear layer or in dentin desensitization, are still highly varied and controversial. Consistent use of lasers in periodontics seems to find scientific support in individuals with systemic alterations that compromise the immune system or in those unable to undergo invasive treatments. In these individuals, the biostimulating effects of irradiation, associated or not with photosensitizers, seem to counteract the cellular adverse effects produced by the disease.

Reynolds M.A et al (2015)[26] conducted a study demonstrating how predictable regeneration of intrabony defects remains an important goal in the management of periodontitis. Clinical and histologic evidence of periodontal regeneration has been shown for multiple regenerative therapies, including bone replacement grafts, guided tissue regeneration, and biologics, when used alone or in combination. Regenerative therapies improve periodontal health, as evidenced by gains in clinical attachment level, reductions in probing depth, and gains in radiographic bone fill. Important patient-related factors (e.g., smoking) and defect/site-related factors (e.g., defect morphology and gingival biotype) can influence the potential to achieve periodontal regeneration. Clinical improvements after regenerative therapy can be maintained over extended periods (‡10 years) with professional maintenance at appropriate intervals and adequate home care. They further concluded periodontal regeneration of intrabony defects is possible using a variety of regenerative strategies. Management should be coupled with an effective oral hygiene and supportive periodontal maintenance program for long-term success

Mathur A., Bains V.K., Gupta V., Singh J.V. G.P.(2015)[40] conducted a study with the objective to compare clinically and radiographically the efficacy of autologous platelet rich fi brin (PRF) and autogenous bone graft (ABG) obtained using bone scrapper in the treatment of intrabony periodontal

defects. The study groups were divided as Thirty-eight intrabony defects (IBDs) were treated with either open flap debridement (OFD) with PRF or OFD with ABG. Clinical parameters were recorded at baseline and 6 months postoperatively. The defect-fill and defect resolution at baseline and 6 months were calculated radiographically (intraoral periapical radiographs [IOPA] and orthopantomogram [OPG]). The results obtained were significant probing pocket depth (PPD) reduction, clinical attachment level (CAL) gain, defect fi ll and defect resolution at both PRF and ABG treated sites with OFD was observed. However, inter-group comparison was non-significant ($P > 0.05$). The bivariate correlation results revealed that any of the two radiographic techniques (IOPA and OPG) can be used for analysis of the regenerative therapy in IBDs. They further concluded that the use of either PRF or ABG were effective in the treatment of three wall IBDs with an uneventful healing of the sites.

Antonio Crispino A. et. al.(2015)[41] conducted a study to evaluate the effect of 940-nm diode laser as an adjunct to SRP in patients affected by periodontitis. They enrolled sixty-eight adult patients with moderate-to-severe periodontitis were sequentially enrolled and undergone to periodontal examination (V1) in order to detect gingival index (GI), plaque index (PI) and probing depth (PD). The patients were randomly divided into two groups: the first (n=34) received SRP treatment alone, the control group (n=34) received SRP and 940-nm diode laser therapy. Data were analyzed by Student's t-test, with two tails; for all clinical parameters, both groups reported statistically significant differences compared to basal values ($p<0.0001$). Both procedures were effective in improving GI, PI and PD, but the use of diode laser was associated with more evident results. They concluded that the diode laser can be routinely associated with SRP in the treatment of periodontal pockets of patients with moderate-to-severe periodontitis.

Lobo T.M. and Pol D.G. (2015)[43] conducted a study to state that lasers have several potential benefits such as antibacterial effect and stimulation of wound healing. In addition, hemostasis and delaying epithelial migration may facilitate the outcome of flap surgery. This study aimed to investigate the adjunctive effect of diode laser irradiation in open flap debridement (OFD), while treating chronic periodontitis. They took in account a total of 30 patients with generalized chronic moderate to severe periodontitis with pocket probing depth (PD) ≥5 mm post - Phase I therapy was selected for a split-mouth study. Flap surgery with adjunctive diode laser irradiation was performed in the test quadrant while routine OFD was done in the control quadrant. Clinical parameters including PD, clinical attachment level, gingival recession, plaque index, gingival index and tooth mobility were recorded at baseline, 3 months and 6 months following treatment. They further concluded that the diode laser can be safely and effectively used as an adjunct to the treatment of chronic periodontitis with the advantage of decreased gingival inflammation.

Juneja (2015)[35] conducted a study with the aim to compare autologous platelet-rich fibrin (PRF) combined with a porous hydroxyapatite bone graft to porous hydroxyapatite bone graft alone in the treatment of periodontal intrabony defects clinically and radiographically using Dentascan **.**In a split-mouth study design, 10 patients suffering from generalized chronic periodontitis, having two almost identical intrabony defects with probing pocket depth of at least 5 mm were selected for the study and randomly divided into two groups. There was statistically significant reduction in probing pocket depth and gain in clinical attachment level in both groups. Spiral multislice computed tomography equipped Dentascan provides three-dimensional images of excellent quality for evaluating the morphology of the periodontal bone defects. They concluded that its use in ascertaining the various defect parameters in the periodontal treatment of intrabony defects is promising.

Fumi Seshima F. et al(2017)[28] published an article with an objective to provide an update on enamel matrix derivative (EMD) has been considered to be one of the few biomaterials for clinical use capable of demonstrating true periodontal regeneration. The aim of this two-center prospective clinical study was to evaluate 2-year outcome of periodontal regenerative therapy using EMD in the treatment of intrabony defects, performed as an 'advanced medical treatment' under the national healthcare system in Japan. They further stated that patients with chronic periodontitis who have completed initial periodontal therapy at either of the two den- tal school clinics were enrolled. Each contributed at least one intrabony defect of ≥3 mm in depth. Mean gains in clinical attachment level (CAL) at 1 and 2 years were 2.9 mm (38% of baseline CAL) and 3.1 mm (41%), respectively, both showing a signifcant improvement from baseline. There was also a signifcant reduction in probing depth (PD): mean reductions at 1 and 2 years were 3.2 and 3.3 mm, respectively. There was a progressive improvement in the mean percentages of bone fll from 26% at 1 year to 36% at 2 years. No significant difference in CAL gain at 2 years was found between 3-wall bone defects and other defect types combined. In multiple regression analysis, the base- line PD was significantly associated with CAL gain at 2 years. In this population of patients, the treatment of intrabony defects with EMD yielded clinically favourable outcomes, as assessed by periodontal and radiographical parameters, over a period of 2 years

Verma U.P., Yadav R.K. , Dixit M. , Gupta A. (2017)[35] reviewed an article regarding periodontal tissue regeneration which has been a challenge for the periodontists owing to its structural complexity. Although with tissue engineering as a growing multidisciplinary field, this aim has partially been fulfilled. In recent years, platelet-rich fibrin (PRF) has gained wide attention for its utilization as a biocompatible regenerative material not only in dental but also in medical fields. The following systematic review had gathered all the currently available in vitro, animal, and clinical studies utilizing PubMed electronic database from January 2006 to August 2016 highlighting PRF for

soft and hard tissue regeneration and/or wound healing. Although results were encouraging but require further validation from clinical studies to justify the potential role of PRF in periodontal regeneration so that this relatively inexpensive autologous biomaterial can be utilized at a wider scale

Deshmukh K. et al. (2018)[44] highlighted different techniques used for periodontal therapy, viz. scaling and root planing, subgingival curettage, gingivectomy, and full- or split-thickness flap procedures with or without osseous recontouring. The study was designed to compare the efficacy of closed pocket debridement with diode laser and periodontal open flap debridement as assessed by clinical and microbiological parameters. The study enrolled twenty patients in an age range of 20–54 years and with pocket depth of ≥5 mm and ≤7 mm were included in the study. The plaque index (PI), gingival index (GI), probing depth (PD), clinical attachment level (CAL), and colony forming units (CFUs) of the periodontal pathogens namely Porphyromonas gingivalis, Fusobacterium nucleatum, Aggregatibacter actinomycetemcomitans, and streptococci were compared in patients undergoing closed pocket debridement with diode laser (Group I) against open flap debridement (Group II) at baseline and after 3 months of the procedure. The laser-treated group (Group I) was found to be better in terms of decrease in clinical PD as compared to Group II. The bactericidal effect of the diode laser was, also, clearly evident by a greater reduction of CFUs of periodontal pathogens in Group I as compared to Group II.

Needleman I.,Worthington H.V.,Leeper E.G., Tucker R. (2019)[45] conducted a study to assess the efficacy of GTR in the treatment of periodontal infra-bony defects measured against conventional surgery (open flap debridement (OFD)) and factors affecting outcomes. They conducted an electronic search of the Cochrane Oral Health Group Trials Register, MEDLINE and EMBASE up to April 2004. Handsearching included Journal of Periodontology, Journal of Clinical Periodontology, Journal of Periodontal Research and bibliographies of all relevant papers and review articles up to

April 2004. In addition, they contacted experts/groups/companies involved in surgical research to find other trials or unpublished material or to clarify ambiguous or missing data and posted requests for data on two periodontal electronic discussion groups. There is therefore little value in future research repeating simple, small efficacy studies. The priority should be to identify factors associated with improved outcomes as well as investigating outcomes relevant to patients. Types of research might include large observational studies to generate hypotheses for testing in clinical trials, qualitative studies on patient-centred outcomes and trials exploring innovative analytic methods such as multilevel modelling. Open flap surgery should remain the control comparison in these studies.

Joanna Kamma (2019)[16] published an article in the journal aimed primarily at clinicians, general practitioners, periodontists, as well as teachers, students, and administrators involved in the organisation of prevention and treatment of periodontal disease. The JCP is published monthly and has an impact factor of 4.046. There were six articles summarised and were published in the JCP in February, March, and May 2019. The article described how leucocyte- and platelet-rich fibrin (L-PRF) has emerged as a highly promising technique with many applications in periodontal therapy. It is being used successfully to repair periodontal bony defects, for ridge preservation, for sinus-floor elevation, and in implant surgery. A key advantage is that the material is completely autogenous so the risks associated with allogenic products can be avoided. Two of the world's leading experts in this area, Marc Quirynen and Nelson Pinto, have explain the biological properties and applications of L-PRF in the article.

Thalaimalai D.B.R., Victor D.J. , Prakash P.S.G. ,Subramaniam S. , Cholan P.K. (2020)[46] published a study with the aim of to evaluate the combined effect of low-level laser therapy (LLLT) and platelet-rich fibrin (PRF), in site modulated intra-bony defects (decortication), which were accessed using a simplified papilla preservation flap (SPPF), on the clinical

and radiographic outcomes of periodontal disease. The study included a total of 30 patients with intra-bony defects were recruited for the study and randomly distributed in two groups (n=15). The plaque and bleeding score, PPD, CAL, and the position of the gingival margin with radiographic defect depth were recorded and analysed at baseline and six months post-intervention using the student's t test and Wilcoxon signed rank test. The results of the test group showed a clinically relevant increase in mean PPD reduction, CAL gain, and radiographic bone fill (3.6 ± 1.35 mm, 3.26 ± 1.16 mm and 2.44 ± 1.24 mm) compared to the control group (2.93 ±1.1 mm, 2.267 ± 1.33 mm and 1.26 ± 0.99 mm) six months post-intervention. They concluded that the results highlights that test protocol had greater amelioration of the effects of periodontal disease and all the investigated clinical and radiographic parameters showed considerable improvement from baseline to 6 months within test and control group, but intergroup comparison between the test and control groups did not show any statistically significant difference, indicating statistical equivalence between the test and control protocol.

Delatola C. , Loos B.G., Laine M.L. (2020)[2] conducted a study to compare three periodontitis clusters (A, B and C) for alveolar bone loss (ABL) patterns, antibiotic prescriptions and surgeries and to relate them to the new classification of periodontitis. They used ABL patterns, prescription of systemic antibiotics and the number of surgeries were retrieved for all patients (n = 353) in the clusters. Comparisons and possible predictors for antibiotics were assessed, and results also evaluated in relation to the new classification. The results demonstrated : Cluster A is characterized by angular defects often affecting the first molars and localized stage III/IV grade C periodontitis. Cluster B contains mainly localized or generalized stage III/IV, grade C patients. Cluster C contains mainly patients with generalized stage III/IV grade C periodontitis. Patients in cluster A received significantly more antibiotics compared to B and C (78% vs. 23% and 17%); the predictors for antibiotic prescription were young age and localized ABL. No differences in numbers of periodontal surgeries were observed between

clusters (A = 1.0 ± 1.4, B = 1.3 ± 1.4 and C = 1.3 ± 1.5). They concluded that within stage III/IV grade C periodontitis, we could detect three clusters of patients. The distinct localized ABL pattern and younger age in cluster A presumably prompted clinicians to prescribe antibiotics.

Pietruszka P. , Chru´scicka I , Du´s-Ilnicka I, Paradowska-Stolarz P (2021)[42] reviewed an article on Blood derivates, such as platelet-rich plasma (PRP) and platelet-rich fibrin (PRF), are autogenous sources of many growth factors that are involved in the healing and regeneration of tissues, and for this reason, are used in dentistry treatments. This fact also contributed to the growing interest in these biomaterials in regenerative personalized medicine. This semi-systematic review described and compared the methods of obtaining properties and potential uses of these materials in personalized treatments. The results of the research that had been carried out so far were promising, but there was a need for further research in the field of PRP and PRF use in personalized dentistry. These kinds of properties are now the most desirable ones, as the products that cause no allergies would be accepted by any organism. This makes PRP and PRF universal products for the treatment of many conditions. The multitude of platelet-rich forms creates many possibilities for their use, for example, in tissue regeneration, intrabony treatments or regenerative endodontic treatments.

Mijiritsky E , Assaf HD , Peleg O , Shacham M , Cerroni L and Mangani L (2021)[6] reviewed an article as how growth factors (GFs) play a vital role in cell proliferation, migration, differentiation and angiogenesis. Autologous platelet concentrates (APCs) which contain high levels of GFs make them especially suitable for periodontal regeneration and facial rejuvenation. The main generations of APCs presented are platelet-rich plasma (PRP), platelet-rich fibrin (PRF) and concentrated growth factor (CGF) techniques. The purpose of this review was to provide the clinician with an overview of APCs' evolution over the past decade in order to give reliable and useful information to be used in clinical work. This review summarized the most interesting and

novel articles published between 1997 and 2020. Electronic and manual searches were conducted in the following databases: Pubmed, Scopus, Cochrane Library and Embase. A total of 73 articles were finally included. The review then addresses the uses of the three different techniques in the two disciplines, as well as the advantages and limitations of each technique.

Miron R.J. et al (2021)[8] conducted a study that aimd to compare the treatment outcomes of periodontal intrabony defects by using platelet-rich fibrin (PRF) with other commonly utilized modalities. The eligibility criteria comprised randomized controlled trials (RCTs) comparing the clinical outcomes of PRF with that of other modalities. Studies were classified into 10 categories as follows: (1) open flap debridement (OFD) alone versus OFD/PRF; (2) OFD/bone graft (OFD/BG) versus OFD/PRF; (3) OFD/BG versus OFD/BG/PRF; (4–6) OFD/barrier membrane (BM), OFD/PRP, or OFD/enamel matrix derivative (EMD) versus OFD/PRF; (7) OFD/EMD versus OFD/EMD/ PRF; (8–10) OFD/PRF versus OFD/PRF/metformin, OFD/PRF/bisphosphonates, or OFD/PRF/statins. Weighted means and forest plots were calculated for probing depth (PD), clinical attachment level (CAL), and radiographic bone fill (RBF). From 551 articles identified, 27 RCTs were included. The use of OFD/PRF statistically significantly reduced PD and improved CAL and RBF when compared to OFD. The addition of all three of the following biomolecules (metformin, bisphosphonates, and statins) to OFD/PRF led to statistically significant improvements of PD, CAL, and RBF. The use of PRF significantly improved clinical outcomes in intrabony defects when compared to OFD alone with similar levels being observed between OFD/BG and OFD/PRF. Future research geared toward better understanding potential ways to enhance the regenerative properties of PRF with various small biomolecules may prove valuable for future clinical applications. They further stated that the future research investigating PRF at histological level is also needed.

Nibali L , Sultan D , Arena C , Pelekos G , Lin GH , Tonetti MS (2021)[47] conducted a study to investigate how well defect morphology is described in papers reporting regenerative therapy of periodontal infrabony defects and to investigate its effect on clinical and radiographic outcomes. A search was conducted in 3 electronic databases for publications reporting clinical and radiographic outcomes of periodontal intrabony defects after regenerative therapy, divided by defect morphology. The initial search resulted in 4487 papers, reduced to 143 after first and second screening. Fifteen of these publications were suitable for a fixed effects meta-analysis. Initial defect depth was found to influence radiographic bone gain 12 months post-surgery, while narrower angles and increased number of walls influenced both radiographic bone gain and clinical attachment level (CAL) gain at 12 months. These associations seemed to occur irrespective of biomaterials used. Risk of bias ranged from low to high. He further concluded that the deeper defects with narrower angles and increased number of walls exhibit improved CAL and radiographic bone gain at 12 months post-regenerative surgery. More data are needed about other aspects of defect morphology such as extension to buccal/lingual surfaces.

Abu-Ta'a M., Karameh R. (2022)[29] reviewed several articles to establish the use of lasers is an emerging therapy in periodontology, however, controversies regarding its use. Despite the vast amount of literature that is currently available, debates regarding the use of lasers in periodontal therapy continue. This review aimed to summarize and clarify the myths surrounding the use of lasers in periodontal therapy, which may offer new hope for the treatment's future treatment options. They used a comprehensive computer-based search was done using various databases like PubMed, Medline, and Cochrane Library. They concluded that the Laser therapy has influenced periodontal treatment in many aspects. The advantages of laser over conventional instruments were reported, which include pain relief, inflammation reduction, tissue repair acceleration, wound healing, reduction of scar formation, removal of granulation tissue and epithelial lining, and treatment of periodontal pockets. There must be careful and strict safety

precautions implemented. Although laser therapy has shown promising results in the treatment of periodontal disease, further research is needed before the clinical use of lasers in evidence-based practice. Further long-term studies and clinical studies in human models are needed to generalize laser therapy in periodontology.

Murugan T., Jayakumar ND, Ganapathy D. (2023)[48] stated the advent and emergence of the use of platelet concentrate in wound healing and how regeneration procedures has opened up an arena of possibilities to explore the potential of these biomimetic agents in periodontal regeneration. This review narrated the role of platelet concentrates in wound healing, regeneration, and the literature evidence of use of iPRF in periodontal therapy. From the evidences in this study it can be concluded that iPRF seems to be a potential agent in enhancing wound healing, regeneration, bone augmentation, repair of endodontic lesions, periodontal regeneration, accelerating orthodontic tooth movements, antimicrobial effect, anti-inflammatory effect etc. Further it has the advantage of being autologous and biomimetic in nature thus eliminating the possibility of immune reaction and other adverse effects related to biocompatibility.

This clinical, experimental, prospective study was carried out in the department of Periodontology, Babu Banarasi Das College of Dental Sciences (BBDCODS), Lucknow. The patients were enrolled according to the following inclusion and exclusion criteria.

Inclusion criteria:

• Patients with PPD≥5mm

• Clinical attachment loss of ≥3mm

• Presence of 2 walled or 3 walled infra-body defects in maxillary and mandibular posterior segments

• Evidence of ≥3mm of intra-bony defect depth evaluated by visualisation of periapical radiographs.

Exclusion criteria:

• Patients who have taken systemic antibiotics in the last 6 months.

• Pregnant and lactating women.

• Patients diagnosed with malocclusion at the site of the defect

• Patients with systemic disease and/or on drugs that contraindicate periodontal surgery

• Patients with history of smoking and tobacco chewing

• Sites with advanced grade II and III furcation involvement.

ARMAMENTARIUM

- Mouth mirrors
- UNC-15 Probe (Hu-Friedy®)
- Tweezer
- Explorer
- Syringe 3ml and 5ml
- BP Blade handle (GDC®)
- Local anaesthetic agent 2% lignocaine (Xicane®)
- BP Blade no. 12 and no. 15
- Saline
- Cotton
- Kidney tray
- A set of surgical curettes (Gracey's Hu-Friedy®)
- Periosteal elevator (GDC®)
- Autologous PRF
- Cumine scaler and condenser (Hu-Friedy®)
- Adams tissue holding forceps
- Laser (Biolaze®)
- Castroviejo scissors (GDC®)
- Needle and Needle holder
- Suture 3-0 (ETHICON Mersilk*)

•Laboratory centrifuge (Forco scientific UdyogPvt.Ltd®)

• Coe-pack® dressing (GC AMERICA INC®)

METHOD

Study Design

This clinical, experimental, prospective study was carried out in the Department of Periodontology, Babu Banarasi Das College of Dental Sciences (BBDCODS), Lucknow. The patients were enrolled according to the inclusion and exclusion criteria.

The treatment procedure was fully explained to the patient in English and Hindi language and a duly signed consent form was taken from all the patients before initiating the treatment. All the 20 patients fulfilling the inclusion and exclusion criteria were randomly divided into the Control Group having patients undergoing open flap debridement with PRF placement at the area of intrabony defect and Test Group with patients undergoing open flap debridement along with biomodulation using LLLT and PRF placement at the site of defect.

CONTROL GROUP:

The surgical procedure was be done under the local infiltration of 2% lignocaine(Xicane®) containing adrenaline at a concentration of 1:100000. Sulcular incision was given and muco-periosteal flaps was reflected. Care should be taken to preserve as much interproximal soft tissue as possible. Complete debridement of the defects (scaling and root planing) to ensure root smoothness, was achieved with the use of ultrasonic instruments(Woodpecker UDS-P led®) and hand curettes(Gracey's Hu-Friedy®). 10 ml of blood was drawn from the subject's median cubital vein. The blood sample was collected in glass tubes not containing any anti-coagulating agent. The blood containing tubes were immediately centrifuged at 3000 rpm for 10 minutes using a laboratory centrifuge (Forco scientific

UdyogPvt.Ltd®). The centrifuged blood mass due to differential densities were separated in three fractions. The structured PRF was easily separated from the lower red corpuscle base (preserving a small RBC layer) using sterile tweezers and scissors just after the removal of 2-3 ml of top acellular plasma and then was transferred on to sterile gauze and used immediately. The retrieved PRF was then cut into two parts, one part compressed between two gauze pieces to convert it to a consistent membrane which was used to cover the grafted defect area and other part will be placed in the defect site. Then the flaps were repositioned and sutured with 3-0 silk sutures(ETHICON Mersilk*) using an interrupted technique followed by periodontal dressings(Coe-pack® dressing (GC AMERICA INC®)).

TEST GROUP:

Periodontal flap surgery was done as mentioned in the Control Group. After completing OFD, the site was modulated with low level laser(Biolaze®) at 0.5 W power, with an uninitiated 0.6mm optical fibre tip will be irradiated for 20 seconds in a continuous non-contact mode and then retracted for 8 seconds. It was then repeated 3 times so that the effectively lased for about 60 seconds. After the biomodulation, the site was grafted with PRF as on the control group into the defect site. Later the flaps were repositioned and sutured with 3-0 silk sutures(ETHICON Mersilk*) using an interrupted technique followed by periodontal dressings(Coe-pack® dressing (GC AMERICA INC®)). The patients was recalled at baseline, 3months & 6 months post operatively and results were recorded and analysed for statistical analysis.

Antibiotic (Augmentin 625 pro) and analgesic (Zerodol®-SP) were prescribed for both the groups. Post operative instructions were given along with the print out copies of instructions in both English and hindi languages. The patients were asked to report after 7-10 days for the periodontal dressing removal, suture removal and clinical examination of the treated site. Patients of both groups were instructed with the oral hygiene measures and recalled

for re-evaluation clinically and radiographically after 3months and 6 months post-operatively.

The following parameters were recorded at baseline, 3months and 6months postoperatively.

The parameters to be assessed are: -

1. Plaque Index
2. Gingival Index
3. Pocket Probing Depth
4. Clinical Attachment Level
5. Intrabony defect viewed with the help of IOPA with grid.

At the end of the study, the entire data was collected and subjected to suitable statistical analysis and interpretation for final results.

CLINICAL PARAMETERS

All the clinical parameters (PI, GI, PPD and CAL) and radiographic parameters were recorded at the baseline (after scaling and root planing) and after 6 months.

- **Plaque Index (Silness and Loe,)[49]**

The Plaque Index (PI) is fundamentally based on the same principle as the Gingival Index, namely the desirability of distinguishing clearly between the severity and the location of the soft debris aggregates. The purpose of introducing this system (Silness and Löe, 1964) was also to create a plaque index which would match the Gingival Index completely.

Criteria for the plaque index system

Score	**Criteria**
0	No plaque in the gingival area
1	A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may only be recognized by running a probe across the tooth surface.
2	Moderate accumulation of soft deposits within the gingival pocket, on the gingival margin and/or adjacent tooth surface, which can be seen by the naked eye.
3	Abundance of soft matter within the gingival pocket and/or on the gingival margin and adjacent tooth surface.

Each of the four gingival areas of the tooth is given a score from 0-3; this is the PI for the area. The scores from the four areas of the tooth may be added and divided by four to give the PI for the tooth. The scores for individual teeth (incisors, premolars and molars) may be grouped to designate the PI for the groups of teeth. Finally, by adding the indices for the teeth and dividing by the number of teeth examined, the PI for the individual is obtained. PI I = 0 is the score given when the gingival area of the tooth surface is literally free of plaque. PI I = 1 represents the situation where the gingival area is covered with a thin film of plaque which is not visible, but which is made visible. PI I = 2 is the score given when the deposit is visible in situ P1I = 3 is reserved for the heavy (1-2 mm. thick) accumulation of soft matter.

- **Gingival Index (Loe and Silness)[49]**

The gingival index (GI), a tool for evaluating the intensity and scope of gingival inflammation in both individuals and subjects within sizable demographic groupings, was first proposed in 1963. The GI just evaluates the gingival tissues. Each of the four gingival regions of the tooth—the face, mesial, distal, and lingual—is examined for inflammation using this procedure, and the degree of inflammation is quantified by assigning each area a score between 0 and 3. A periodontal probe is used to examine bleeding by moving it over the gingival crevice's soft tissue wall. To determine the tooth score, add the scores for the four tooth locations and divide the result by 4. By adding the tooth scores together and dividing by the number of teeth examined, an individual's GI score can be obtained.

Scores and Criteria for Gingival Index (GI)

Score	**Criteria**
0	Normal gingiva
1	Mild inflammation: slight change in color and slight edema; no bleeding on probing

2	Moderate inflammation: redness, edema, and glazing; bleeding on probing
3	Severe inflammation: marked redness and edema; ulceration; tendency to spontaneous bleeding

- **Probing pocket depth**[50]

The PPD was measured from the base of the crevice to the gingival margin in order to determine the depth of the probe (i.e., where the probe tip stops). Exploration with a periodontal probe is the only reliable way to locate and measure periodontal pockets. By using a radiographic examination, pockets are not found. An alteration to soft tissue is the periodontal pocket. Radiographs show areas of bone loss where pockets may be suspected, but they do not show the presence or depth of pockets, therefore they do not distinguish between the presence of pockets before and after their removal unless the bone has been altered. In cases of gingival inflammation, probing depth is often greater than 3 mm and less than 3 mm in cases of gingival health. Numerous investigations have been conducted to establish the probe's depth of penetration in a pocket or sulcus. Beagle dogs were employed by Armitage and colleagues8 to assess the probe's penetration when a standard force of 25 g was applied.

- **Clinical Attachment Level**[51]

The term "attachment level" refers to the region on a tooth where the dentogingival junction first appears coronally. The distance between the attachment level and a reference point on a tooth, like the cementoenamel junction, is measured by clinical attachment level. Gains or losses in

attachment can cause changes in the attachment level, which can give a more accurate indicator of the level of periodontal gain or destruction.

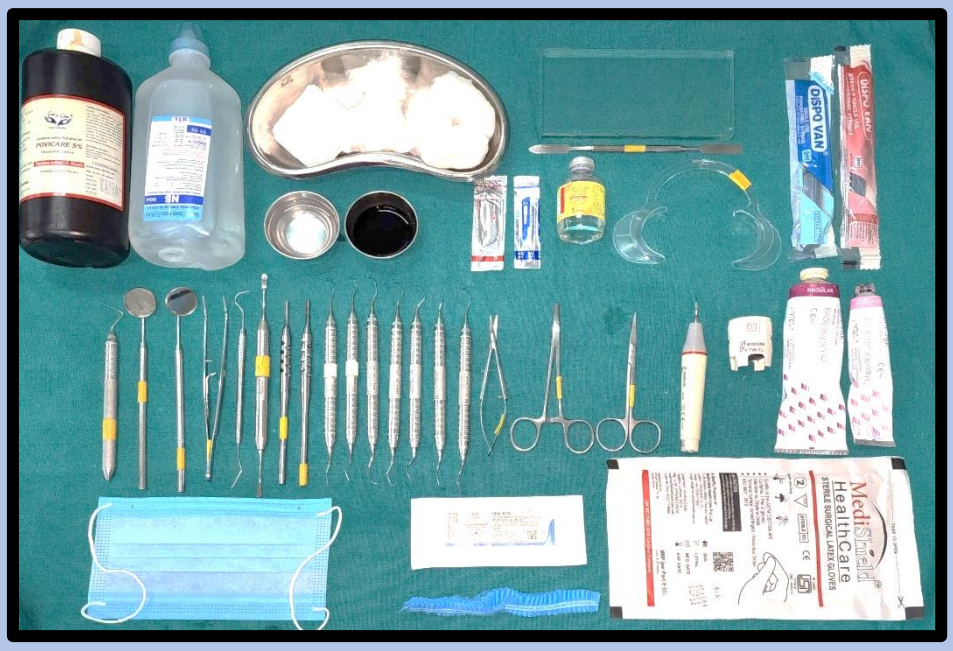
Clinical attachment loss (CAL) is used to categorise the severity of chronic periodontitis into three categories:

Severity	**Parameters**
Mild	1–2 mm CAL
Moderate	3–4 mm CAL
Severe	(>5 mm CAL

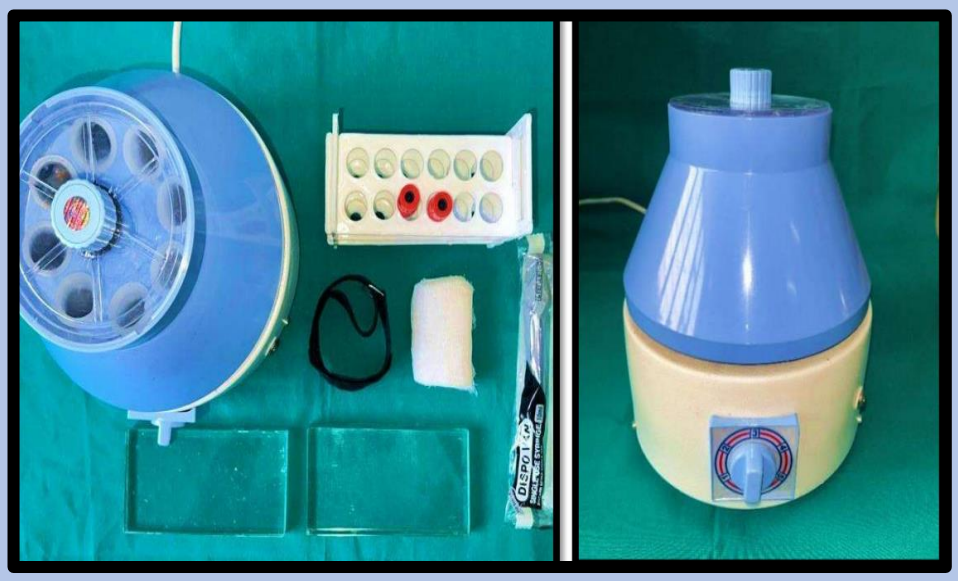
• **Radiographic evaluation**:

After taking the IOPAR, bone level was measured from most coronal to the most apical point in the intrabony defect for both the groups, first at the baseline, 3 months and 6 months post surgically. An IOPA was captured with paralleling technique using Unicorn RVG senor, Genoray Portable Xray unit XII and a graduated grid.

SURGICAL ARMAMENTARIUM

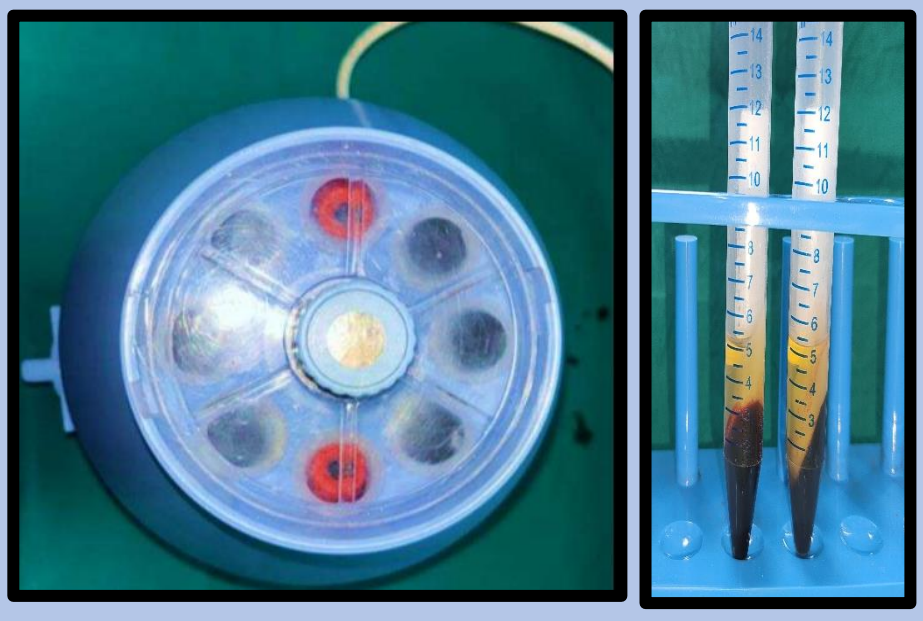


Photograph 1: Armamentarium

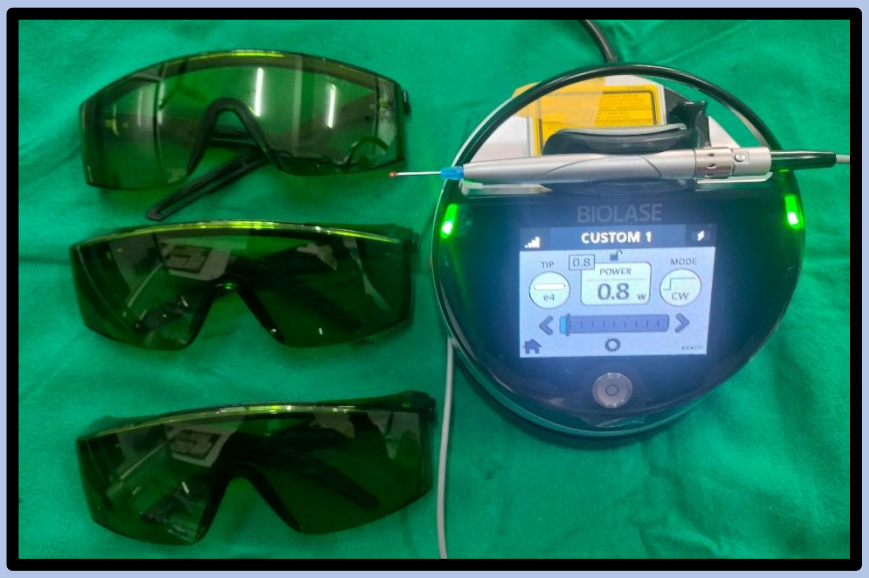


Photograph 2: Armamentarium for obtaining PPE

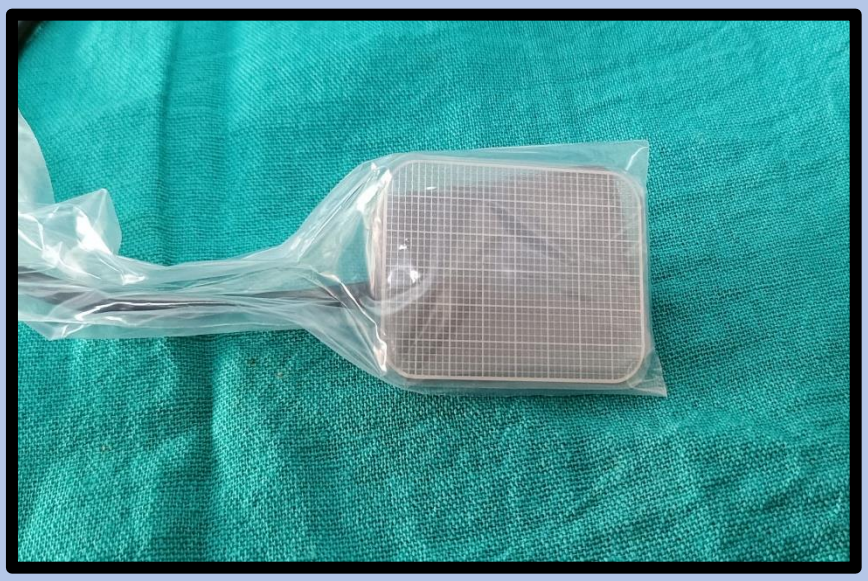
Photograph 3: Autologous blood withdrawal



Photograph 4: Laboratory centrifuge and PRF

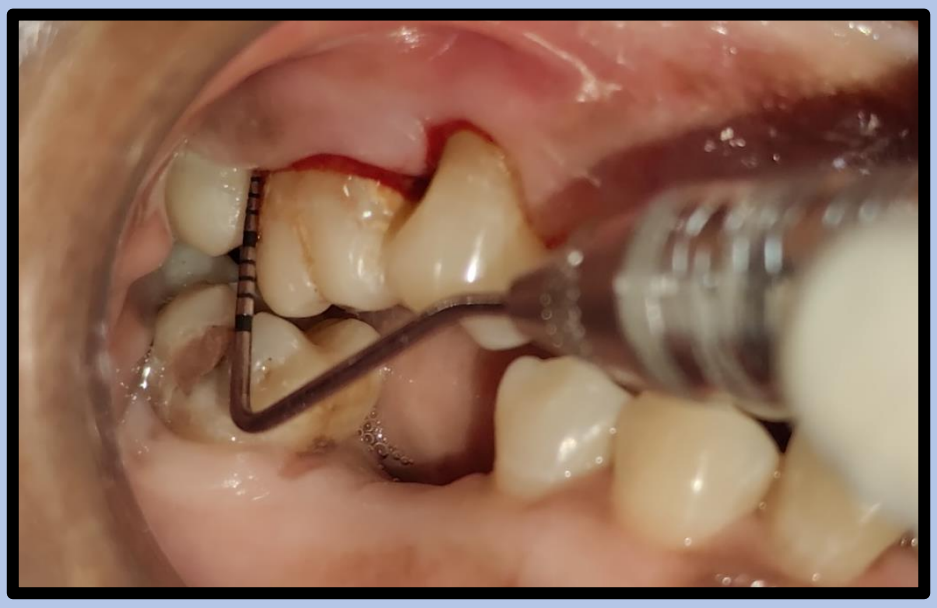


Photograph 5: LASER (Biolaze®)

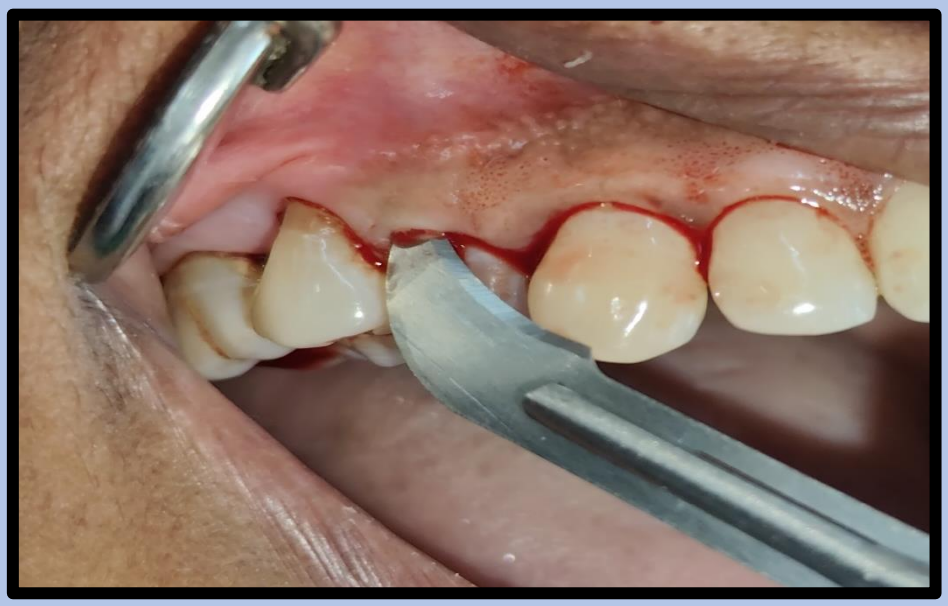


Photograph 6: RVG sensor with grid

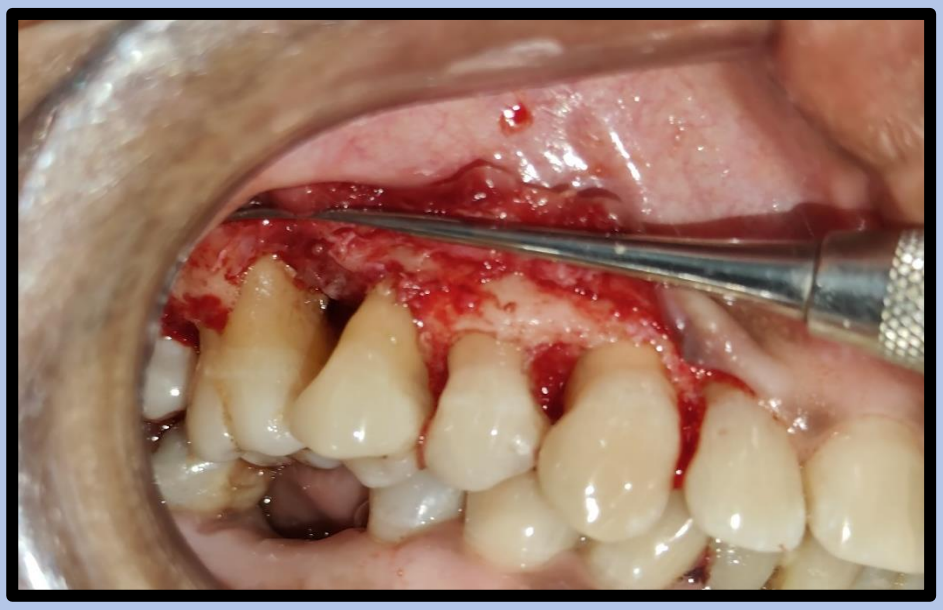
Test Group – OFD + LASER + PRF



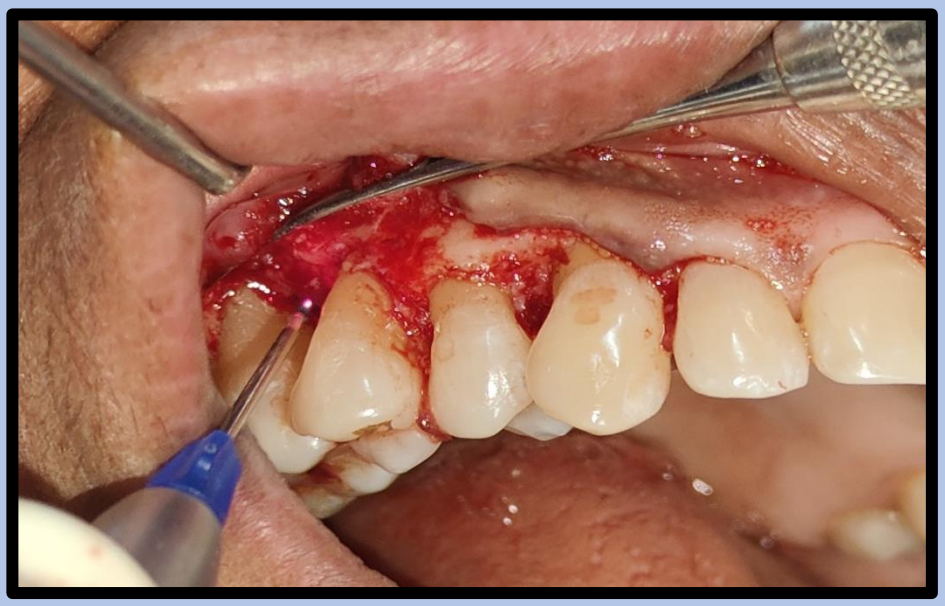
Photograph 7(i): Pre-Operative Probing Pocket Depth



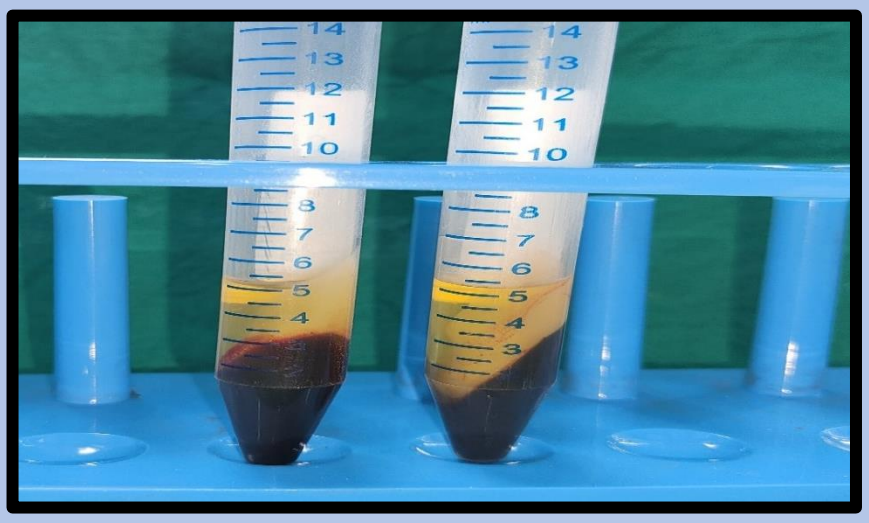
Photograph 7(ii): Crevicular Incision



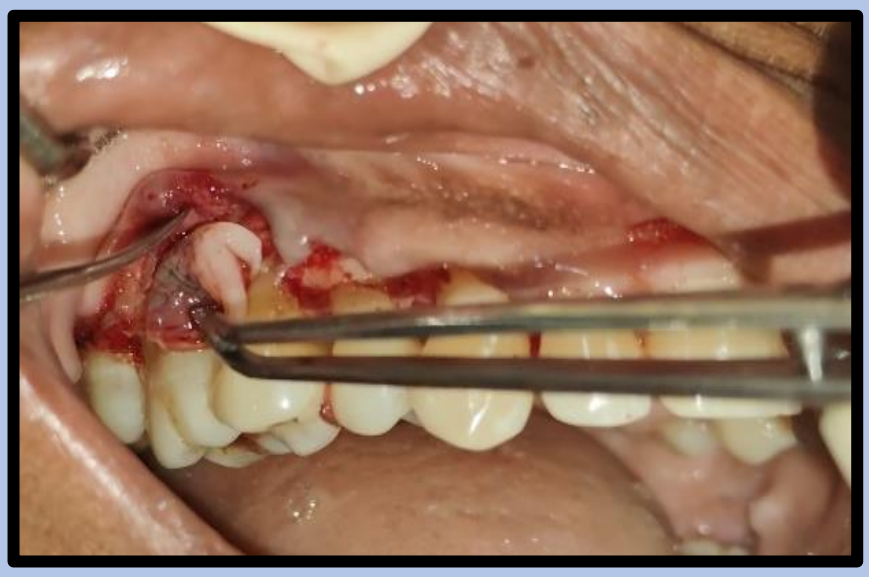
Photograph 7(iii): Flap Reflection



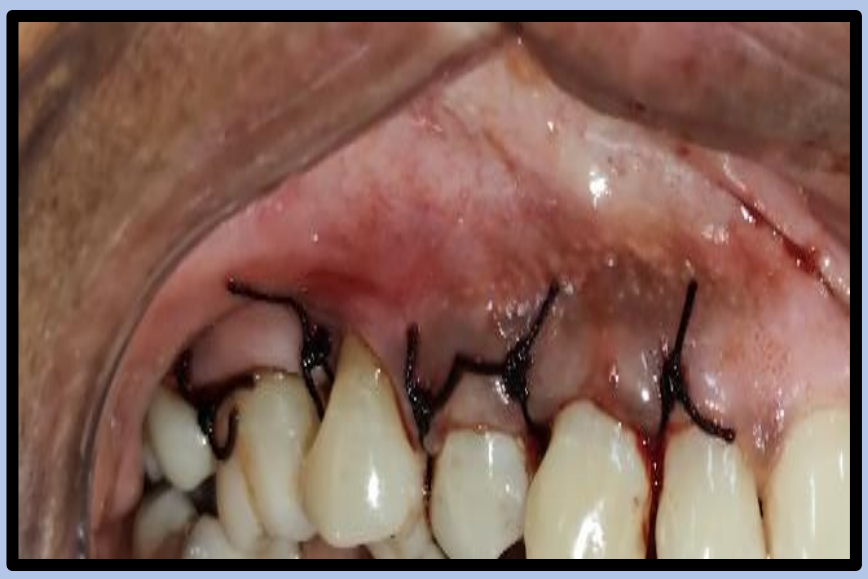
Photograph 7(iv): Biomodulation By LASER



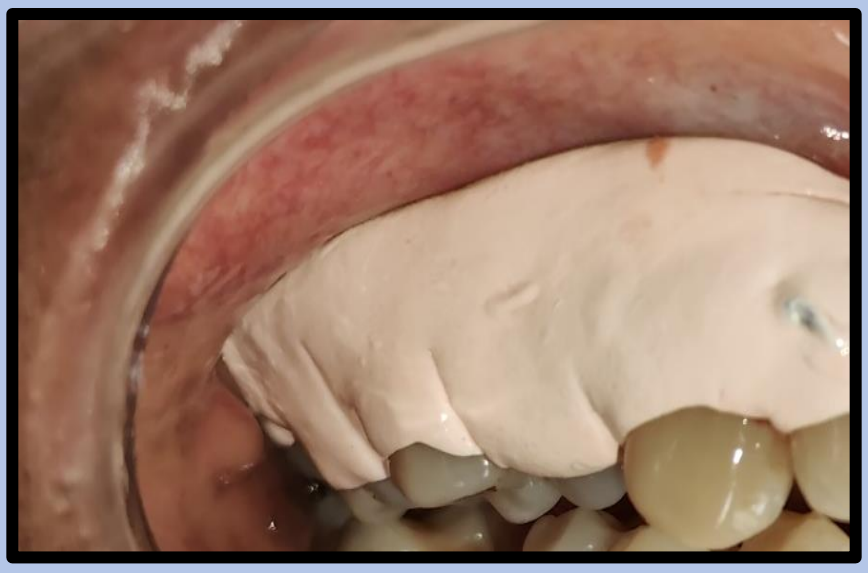
Photograph 7(v): PRF



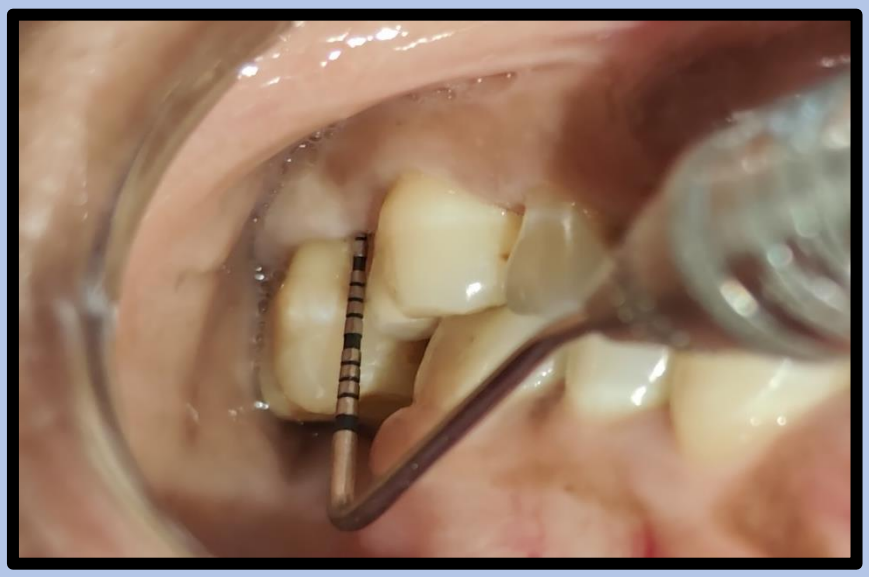
Photograph 7(vi): PRF membrane placement



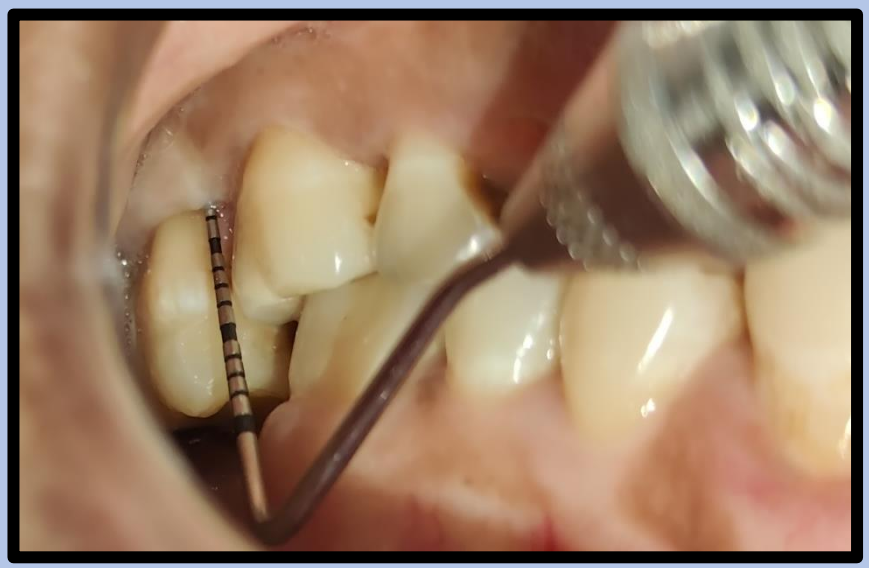
Photograph 7(vii): Suture placement



Photograph 7(viii): Periodontal dressing given



Photograph 7(ix): Post Operative Probing Pocket Depth – 3months



Photograph 7(x): Post Operative Probing Pocket Depth – 6months

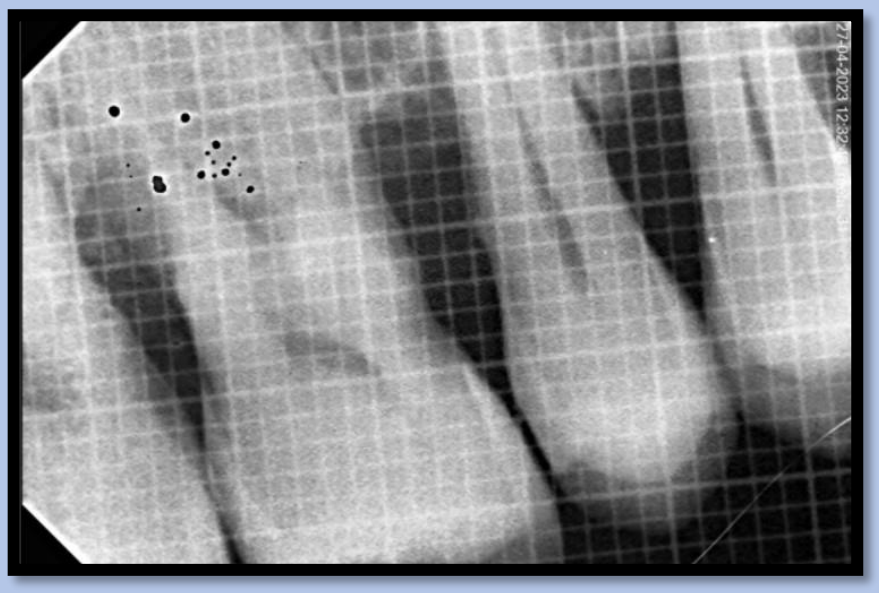


Figure 7(xi): IOPAR at baseline

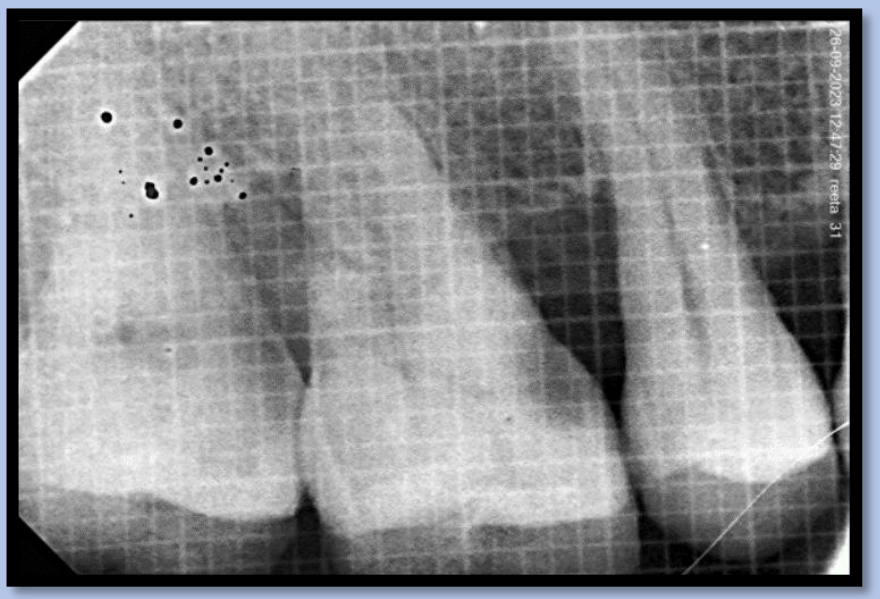
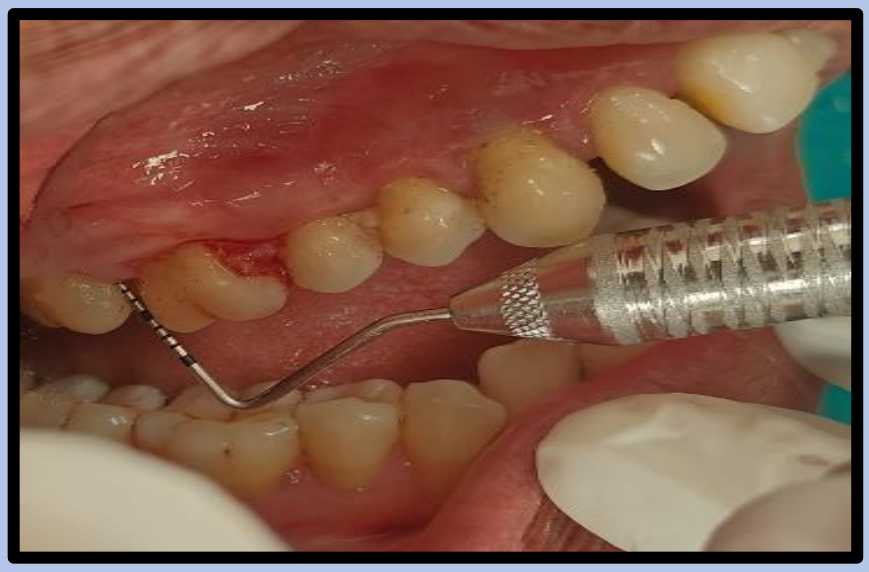
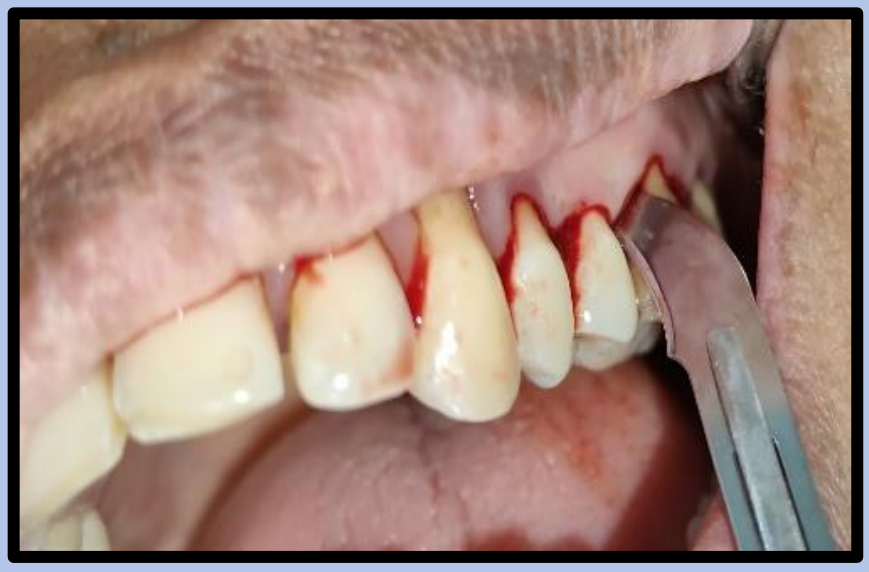


Figure 7(xii): IOPAR at 3 months

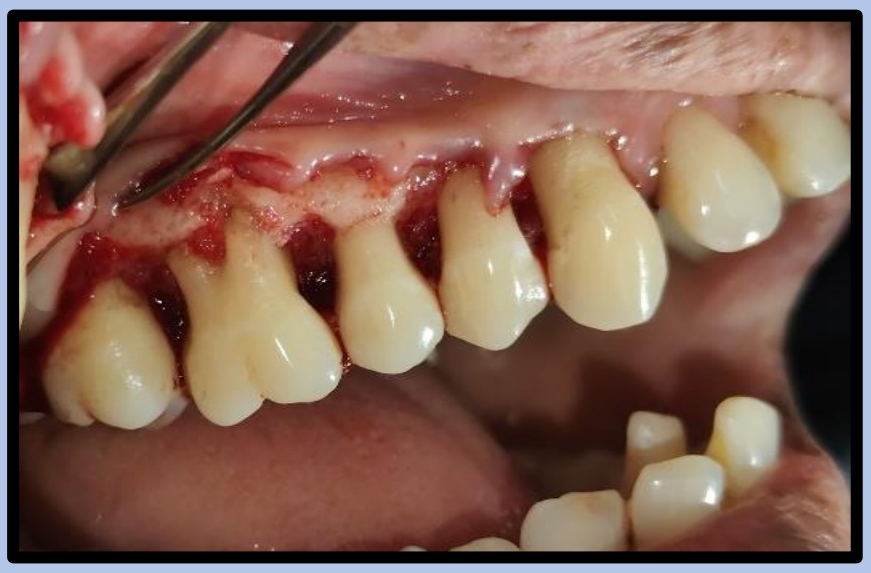
Control Group – OFD + PRF



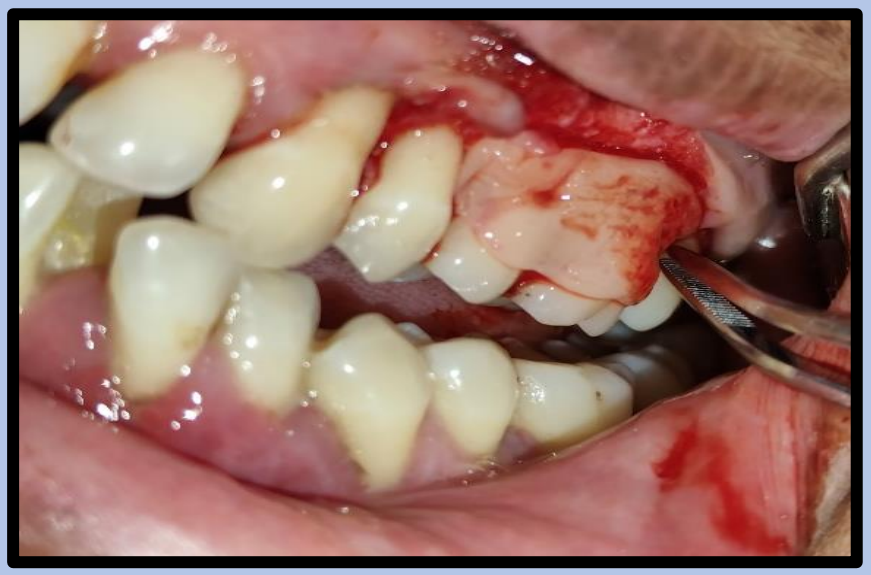
Photograph 8(i): Pre-Operative Probing Pocket Depth



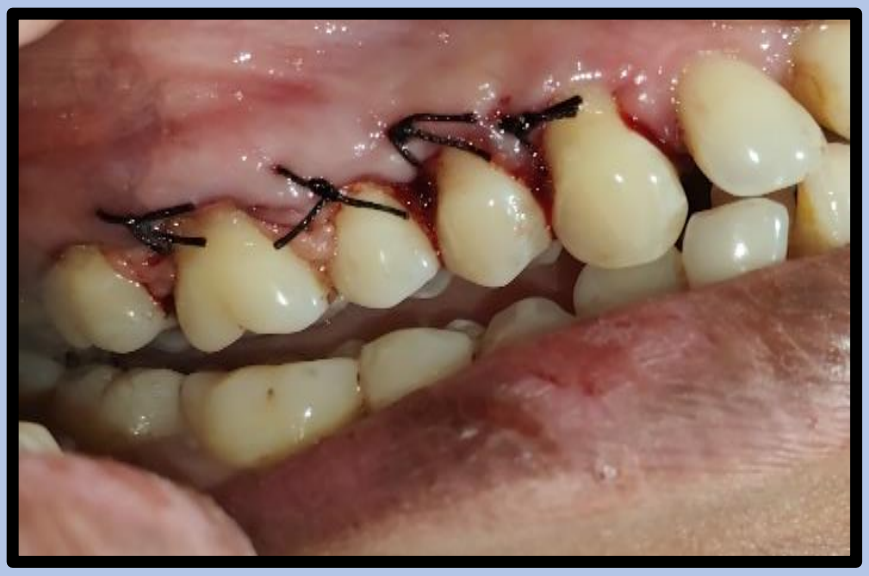
Photograph 8(ii): Crevicular Incision



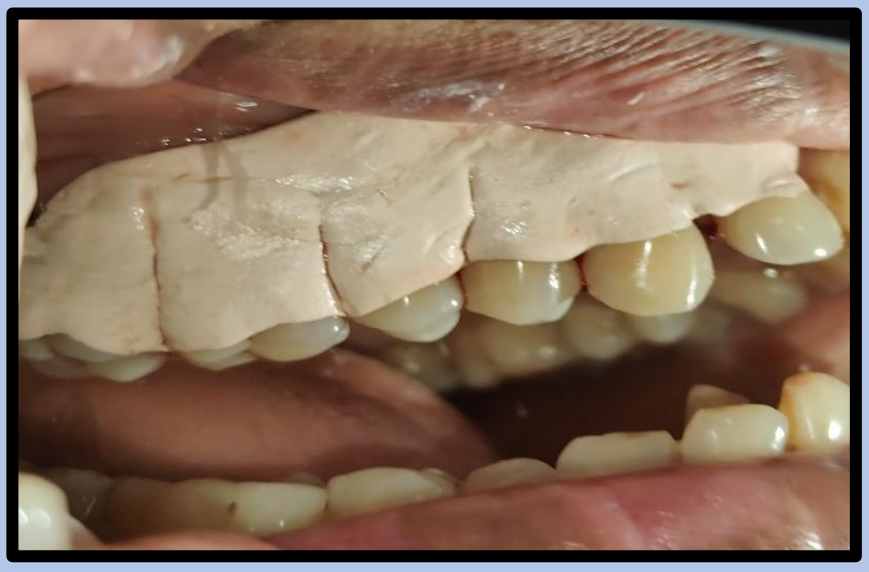
Photograph 8(iii): Flap Reflection



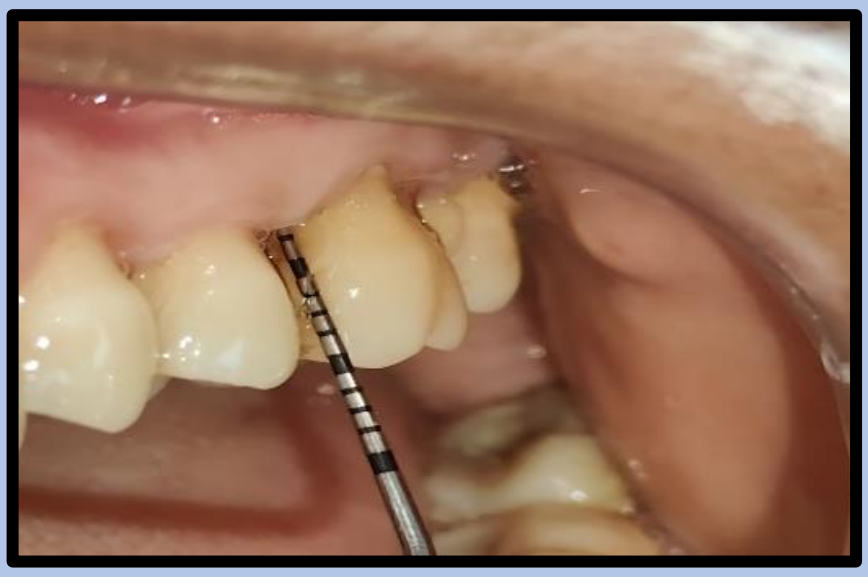
Photograph 8(iv): PRF membrane placement



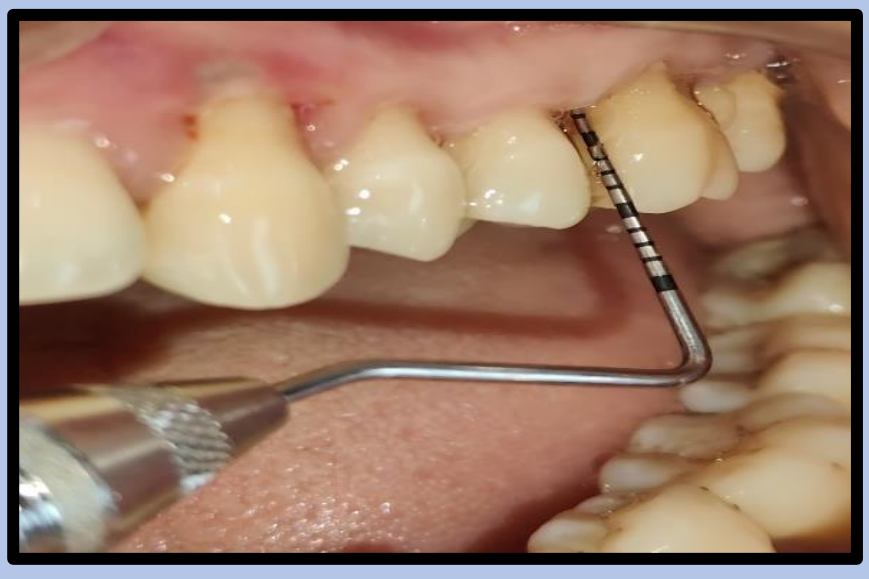
Photograph 8(v): Suture placement



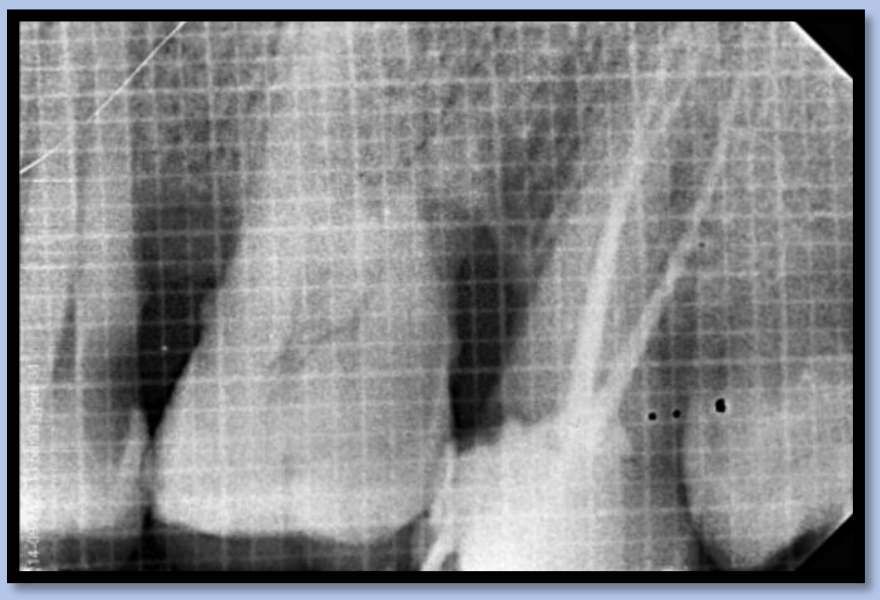
Photograph 8(vi): Periodontal dressing given



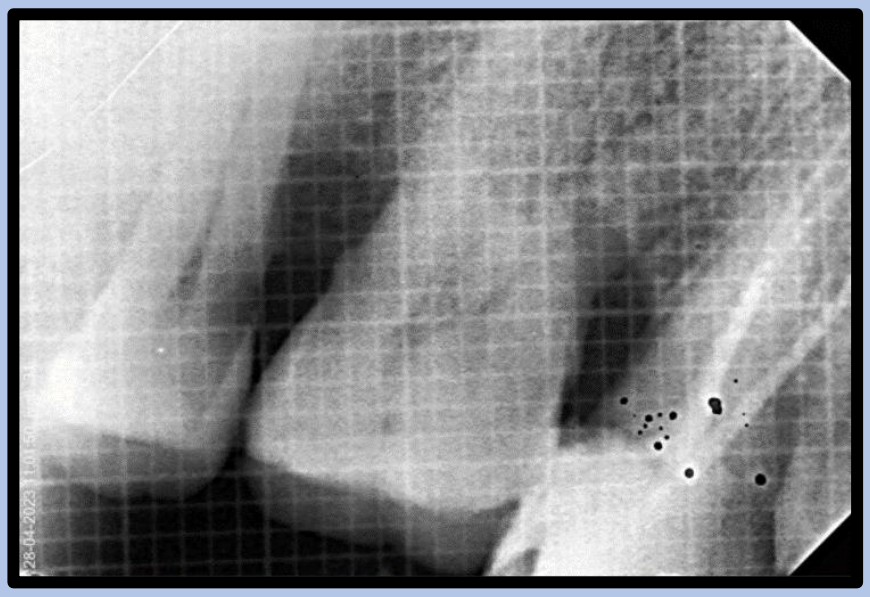
Photograph 8(vii): Post Operative Probing Pocket Depth – 3months



Photograph (viii): Post Operative Probing Pocket Depth – 3months



Photograph 8(ix): IOPAR at baseline



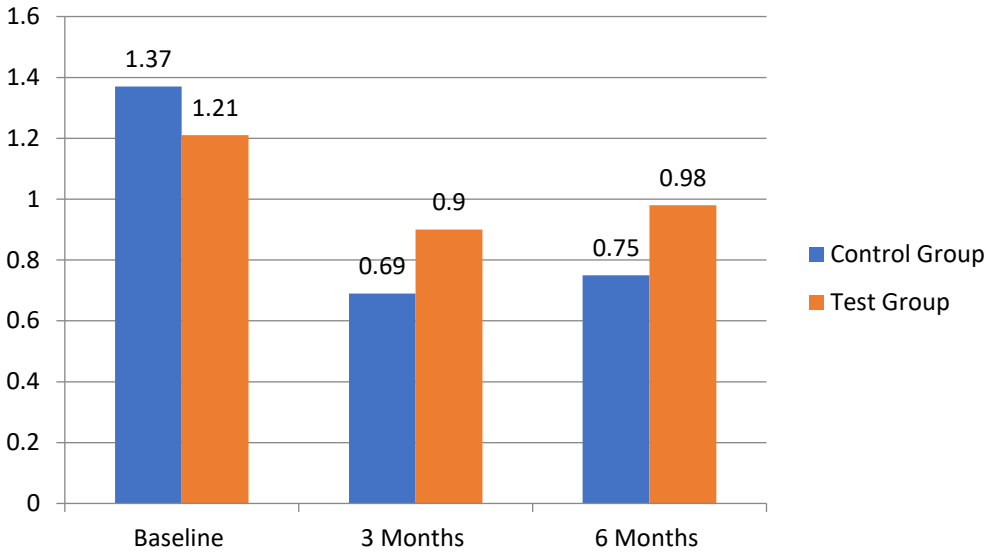
Photograph 8(x): IOPAR at 3 months

INTERGROUP COMPARISON OF PLAQUE INDEX BETWEEN THE GROUPS AT DIFFERENT TIME INTERVALS

The mean plaque score at the baseline 1.370 in the control group and 1.210 in the test group. At the 3 months time interval the mean plaques score was 0.690 in the control group and 0.900 in the test group. At 6 months the mean plaque score was 0.75 in the control group and 0.98 in the test group. The intergroup comparison between the groups at baseline, 3 months and 6 months was statistically non-significant when analysed using independent t test .

		Mean	Std Dev	Std Error	P value	Significance
Baseline	Control Group	1.370	0.283	0.089	0.331	Non-Significant
	Test Group	1.210	0.420	0.132		
3 months	Control Group	0.690	0.172	0.054	0.071	Non-Significant
	Test Group	0.900	0.294	0.093		
6 Months	Control Group	0.750	0.283	0.089	0.119	Non-Significant
	Test Group	0.980	0.342	0.108		

Table 1: Intergroup comparison of plaque index between the groups at different time intervals



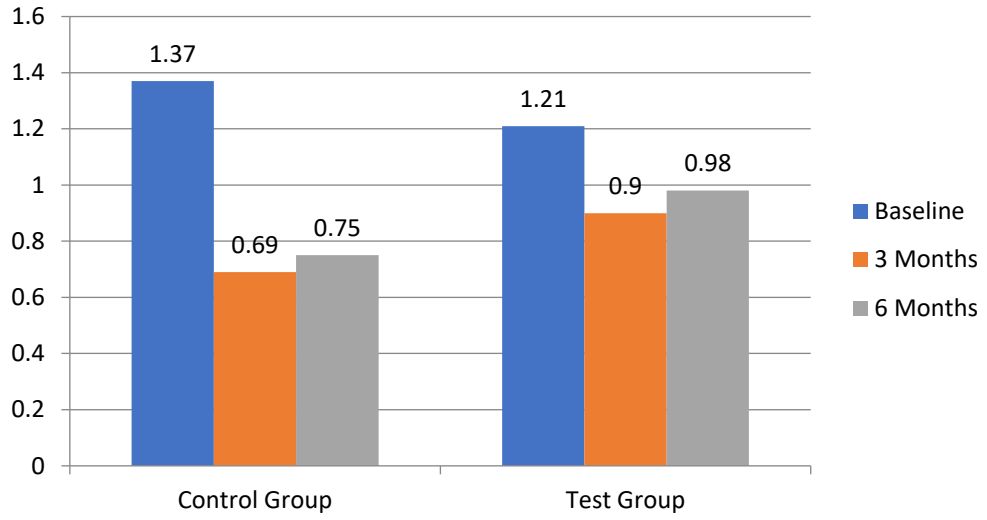
Graph 1: Intergroup comparison of plaque index between the groups at different time

INTRAGROUP COMPARISON OF PLAQUE INDEX BETWEEN THE DIFFERNT TIME INTERVALS INTERVALS

The mean plaque score at the baseline 1.370 in the control group and 1.210 in the test group . At the 3 months time interval the mean plaques score was 0.690 in the control group and 0.900 in the test group. At 6 months the mean plaque score was 0.75 in the control group and 0.98 in the test group. , The intragroup change from baseline to 3 months and 6 months was statistically significant but change between 3 months and 6 months was statistically non-significant.

	Baseline	3 Months	6 Months	Baseline –3 Months	Baseline – 6 Months	3 Months-6 Months
Control Group	1.37±0.28	0.69±0.17	0.75±0.28	0.012 (Sig)	0.021 (Sig)	0.690 (Non-Sig)
Test Group	1.21±0.42	0.90±0.29	0.98±0.34	0.039 (Sig)	0.046 (Sig)	0.598 (Non-Sig)

Table 2 : intragroup comparison of plaque index between the different time intervals



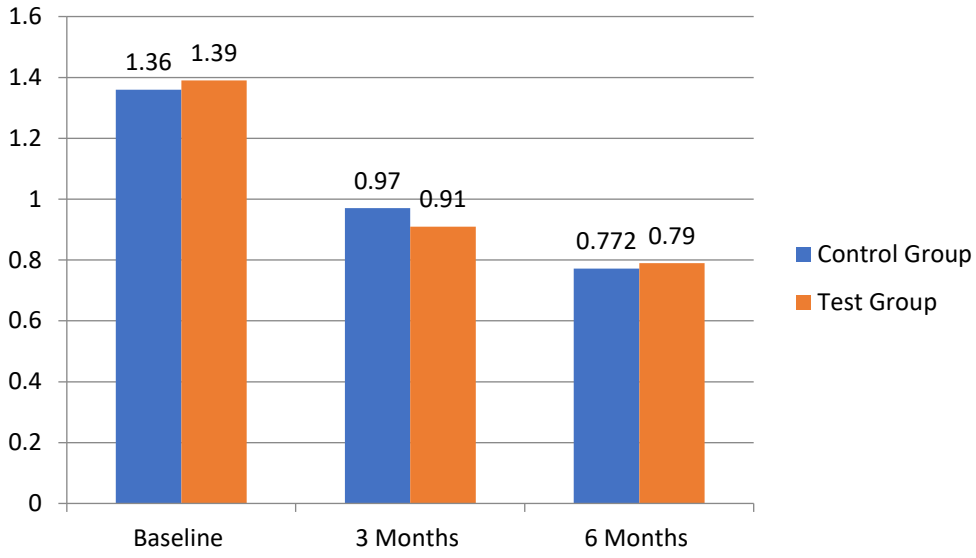
Graph 2 : intragroup comparison of plaque index between the different time intervals

INTERGROUP COMPARISON OF GINGIVAL INDEX BETWEEN THE GROUPS AT DIFFERENT TIME INTERVALS

The mean gingival score at the baseline 1.360 in the control group and 1.390 in the test group. At the 3 months time interval the mean gingival score was 0.970 in the control group and 0.910 in the test group. At 6 months the mean gingival score was 0.772 in the control group and 0.790 in the test group. The intergroup comparison between the groups at baseline, 3 months and 6 months was statistically non-significant when analyzed using independent t test .

		Mean	Std Dev	Std Error	P value	Significance
Baseline	Control Group	1.360	0.201	0.063	0.976	Non-Significant
	Test Group	1.390	0.378	0.119		
3 months	Control Group	0.970	0.221	0.070	0.653	Non-Significant
	Test Group	0.910	0.351	0.111		
6 Months	Control Group	0.772	0.166	0.052	0.904	Non-Significant
	Test Group	0.790	0.433	0.136		

Table 3 : Intergroup comparison of gingival index between the groups at different time intervals



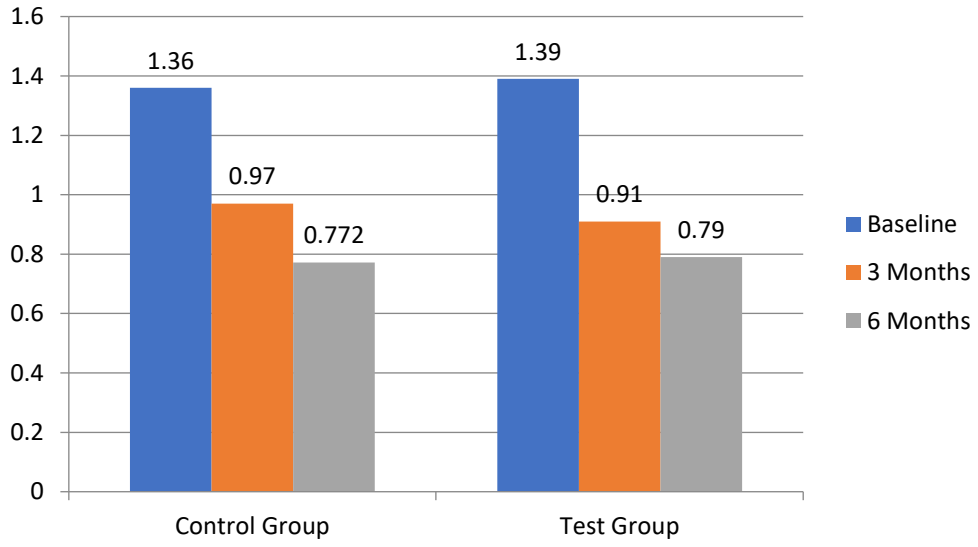
Graph 3 : Intergroup comparison of gingival index between the groups at different time intervals

INTRAGROUP COMPARISON OF GINGIVAL INDEX BETWEEN THE DIFFERNT TIME INTERVALS

The mean gingival score at the baseline 1.360 in the control group and 1.390 in the test group. At the 3 months time interval the mean gingival score was 0.970 in the control group and 0.910 in the test group. At 6 months the mean gingival score was 0.772 in the control group and 0.790 in the test group. The intragroup change from baseline to 3 months and 6 months was statistically significant but change between 3 months and 6 months was statistically non-significant.

	Baseline	3 Months	6 Months	Baseline – 3 Months	Baseline –6 Months	3 Months-6 Months
Control Group	1.36±0.20	0.97±0.22	0.77±0.16	0.010 (Sig)	0.002 (Sig)	0.496 (Non-Sig)
Test Group	1.39±0.37	0.91±0.35	0.79±0.43	0.007 (Sig)	0.005 (Sig)	0.345 (Non-Sig)

Table 4 : The intragroup change from baseline to 3 months and 6 months



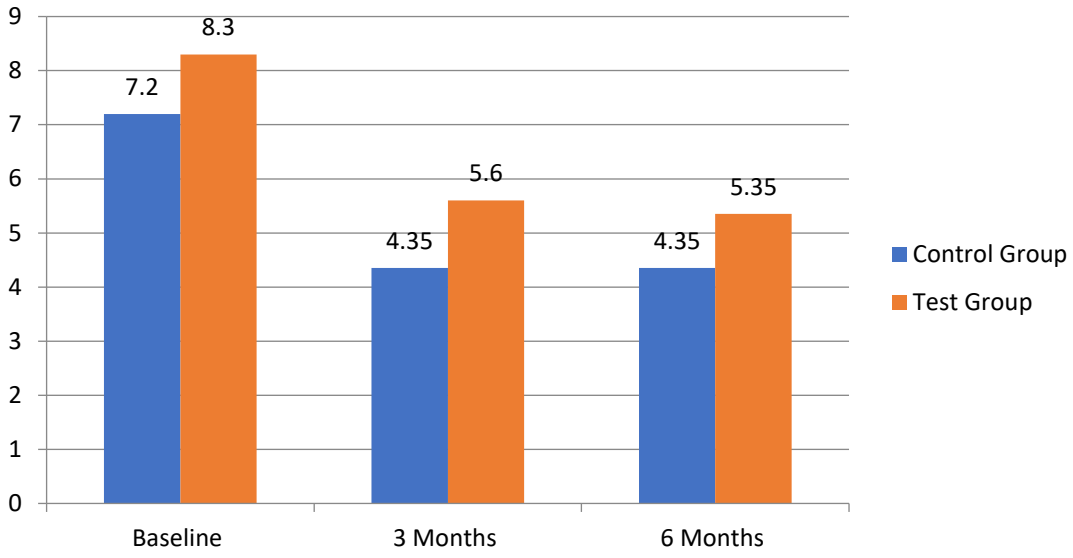
Graph 4 : The intragroup change from baseline to 3 months and 6 months

INTERGROUP COMPARIOSN OF PROBING DEPTH BETWEEN THE GROUPS AT DIFFERENT TIME INTERVALS

The mean probing depth at the baseline 7.20 in the control group and 8.30 in the test group . At the 3 months time interval the mean probing depth was 4.35 in the control group and 5.60 in the test group. At 6 months the mean probing depth was 4.35 in the control group and 5.35 in the test group. The intergroup comparison between the groups at baseline, 3 months and 6 months was statistically non-significant when analyzed using independent t test .

		Mean	Std Dev	Std Error	P value	Significance
Baseline	Control Group	7.200	1.135	0.359	**0.164**	Non-Significant
	Test Group	8.300	2.110	0.667		
3 months	Control Group	4.350	0.747	0.236	**0.134**	Non-Significant
	Test Group	5.600	2.836	0.896		
6 Months	Control Group	4.350	0.818	0.258	**0.201**	Non-Significant
	Test Group	5.350	2.867	0.906		

Table 5 : The intergroup comparison between the groups at baseline, 3 months and 6 months



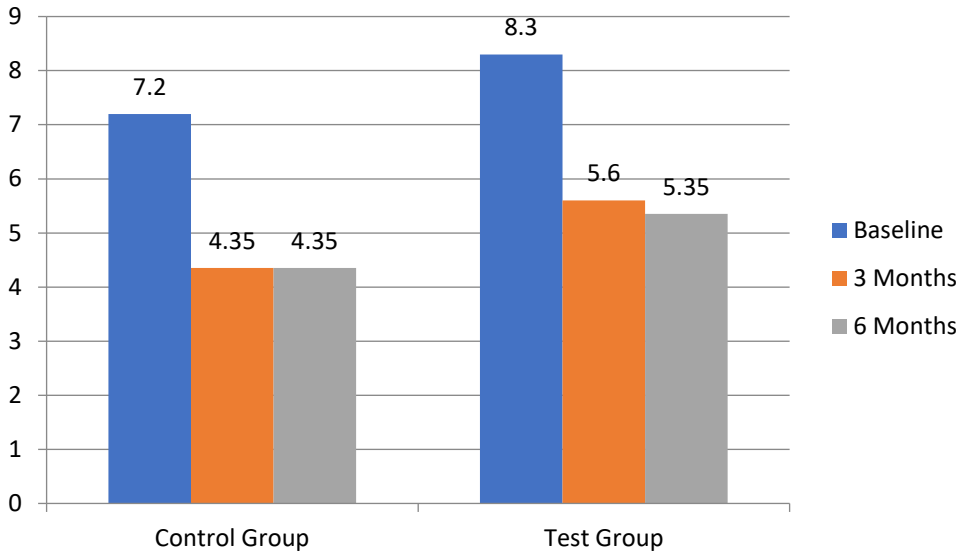
Graph 5 : The intergroup comparison between the groups at baseline, 3 months and 6 months

INTRAGROUP COMPARISON OF PROBING DEPTH BETWEEN THE DIFFERNT TIME INTERVALS

The mean probing depth at the baseline 7.20 in the control group and 8.30 in the test group . At the 3 months time interval the mean probing depth was 4.35 in the control group and 5.60 in the test group. At 6 months the mean probing depth was 4.35 in the control group and 5.35 in the test group. The intragroup change from baseline to 3 months and 6 months was statistically significant but change between 3 months and 6 months was statistically non-significant.

	Baseline	3 Months	6 Months	Baseline –3 Months	Baseline –6 Months	3 Months-6 Months
Control Group	7.20±1.13	4.35±0.74	4.35±0.81	0.030 (Sig)	0.030 (Sig)	1.000 (Non-Sig)
Test Group	8.30±2.11	5.60±2.83	5.35±0.26	0.021 (Sig)	0.010 (Sig)	0.916 (Non-Sig)

Table 6 : The intragroup change from baseline to 3 months and 6 months



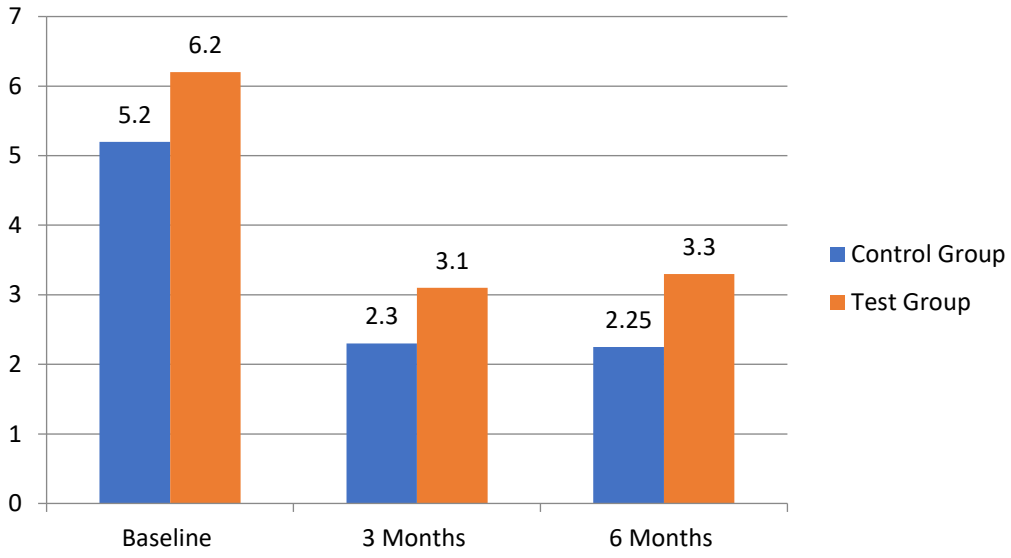
Graph 6 : The intragroup change from baseline to 3 months and 6 months

INTERGROUP COMPARIOSN OF CAL BETWEEN THE GROUPS AT DIFFERENT TIME INTERVALS

The mean CAL at the baseline 5.20 in the control group and 6.20 in the test group . At the 3 months time interval the mean CAL was 2.30 in the control group and 3.10 in the test group. At 6 months the mean CAL was 2.25 in the control group and 3.30 in the test group. The intergroup comparison between the groups at baseline, 3 months and 6 months was statistically non-significant when analysed using independent t test

		Mean	Std Dev	Std Error	P value	Significance
Baseline	Control Group	5.200	1.316	0.416	0.201	Non-Significant
	Test Group	6.200	2.043	0.646		
3 months	Control Group	2.300	0.823	0.260	0.310	Non-Significant
	Test Group	3.100	2.960	0.936		
6 Months	Control Group	2.250	0.634	0.200	0.273	Non-Significant
	Test Group	3.300	2.790	0.882		

Table 7 : The intergroup comparison between the groups at baseline, 3 months and 6 months



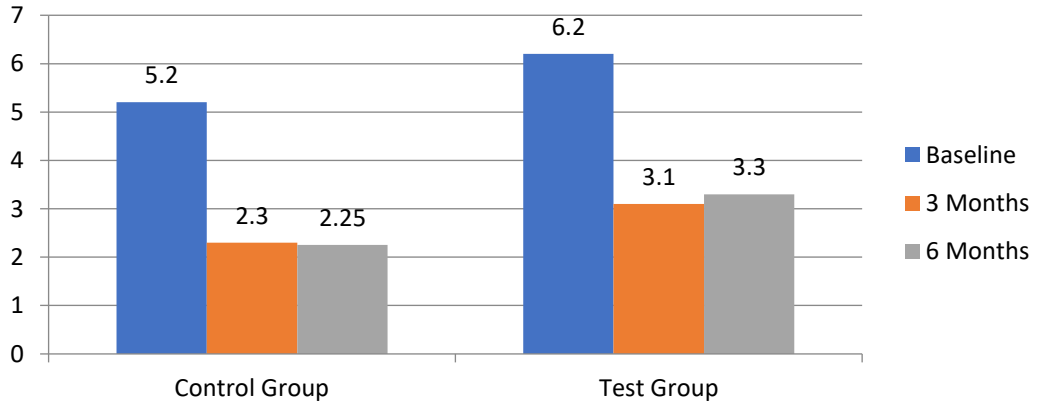
Graph 7 : The intergroup comparison between the groups at baseline, 3 months and 6 months

INTRAGROUP COMPARISON OF CAL BETWEEN THE DIFFERNT TIME INTERVALS

The mean CAL at the baseline 5.20 in the control group and 6.20 in the test group. At the 3 months time interval the mean CAL was 2.30 in the control group and 3.10 in the test group. At 6 months the mean CAL was 2.25 in the control group and 3.30 in the test group. The intragroup change from baseline to 3 months and 6 months was statistically significant but change between 3 months and 6 months was statistically non-significant.

	Baseline	3 Months	6 Months	Baseline –3 Months	Baseline–6 Months	3Months-6 Months
Control Group	5.20±1.31	2.30±0.82	2.25±0.63	0.001 (Sig)	0.001 (Sig)	0.987 (Non-Sig)
Test Group	6.20±2.04	3.10±2.96	3.30±2.79	0.001 (Sig)	0.001 (Sig)	0.910 (Non-Sig)

Table 8 : The intragroup comparison between the groups at baseline, 3 months and 6 months



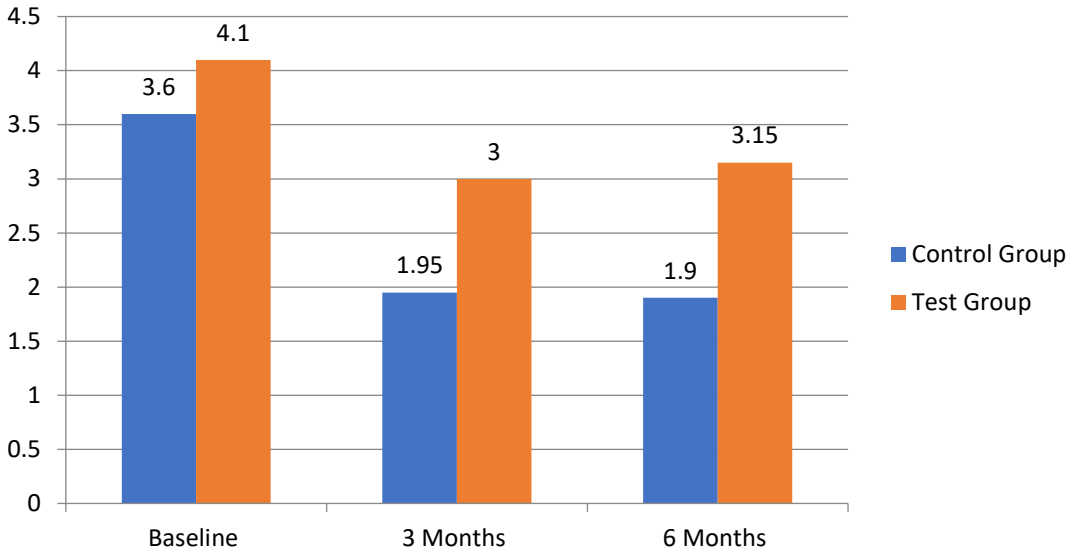
Graph 8 : The intragroup comparison between the groups at baseline, 3 months and 6 months

INTERGROUP COMPARIOSN OF BONE LEVEL BETWEEN THE GROUPS AT DIFFERENT TIME INTERVALS

The mean Bone level at the baseline 3.60 in the control group and 4.10 in the test group . At the 3 months time interval the mean bone level was 1.95 in the control group and 3.00 in the test group. At 6 months the mean bone level was 1.90 in the control group and 3.15 in the test group. The intergroup comparison between the groups at 3 months and 6 months was statistically significant when analyzed using independent t test .

		Mean	Std Dev	Std Error	P value	Significance
Baseline	Control Group	3.600	0.843	0.266	0.376	Non-Sig
	Test Group	4.100	1.523	0.481		
3 months	Control Group	1.950	0.685	0.216	0.017	Sig
	Test Group	3.000	1.054	0.333		
6 Months	Control Group	1.900	1.286	0.406	0.043	Sig
	Test Group	3.150	1.491	0.471		

Table 9 : The intergroup comparison between the groups at baseline, 3 months and 6 months



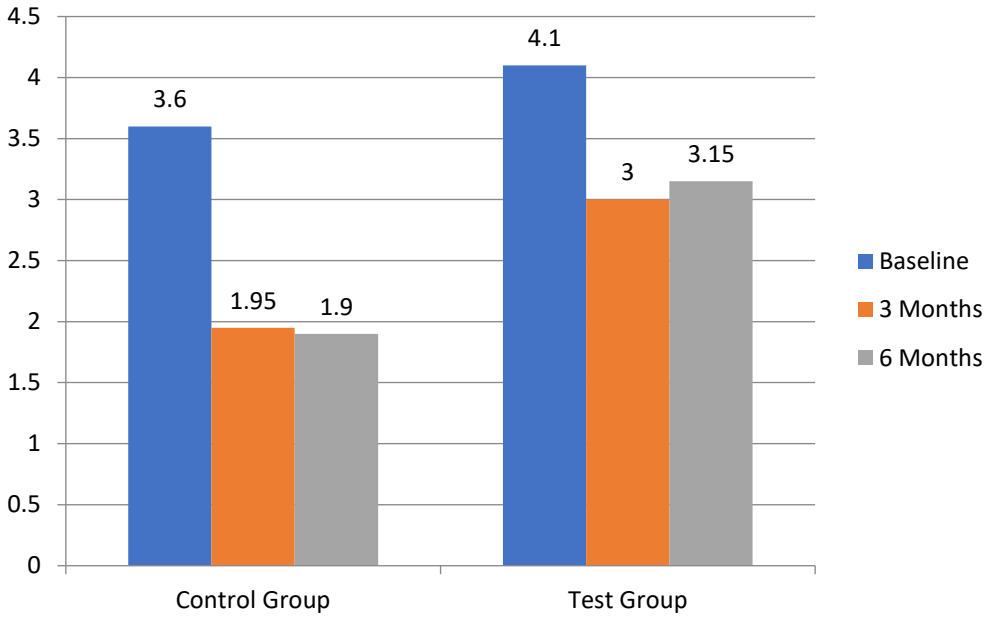
Graph 9: The intergroup comparison between the groups at 3 months and 6 months

INTRAGROUP COMPARISON OF BONE LEVEL BETWEEN THE DIFFERNT TIME INTERVALS

The mean Bone level at the baseline 3.60 in the control group and 4.10 in the test group . At the 3 months time interval the mean bone level was 1.95 in the control group and 3.00 in the test group. At 6 months the mean bone level was 1.90 in the control group and 3.15 in the test group. The intragroup change from baseline to 3 months and 6 months was statistically significant but change between 3 months and 6 months was statistically non-significant.

	Baseline	3 Months	6 Months	Baseline – 3 Months	Baseline –6 Months	3Months-6 Months
Control Group	3.60±0.84	1.95±0.68	1.90±1.28	0.013 (Sig)	0.018 (Sig)	0.982 (Non-Sig)
Test Group	4.10±1.52	3.00±1.05	3.15±1.49	0.042 (Sig)	0.049 (Sig)	0.967 (Non-Sig)

Table 10: The intragroup change from baseline to 3 months and 6 months



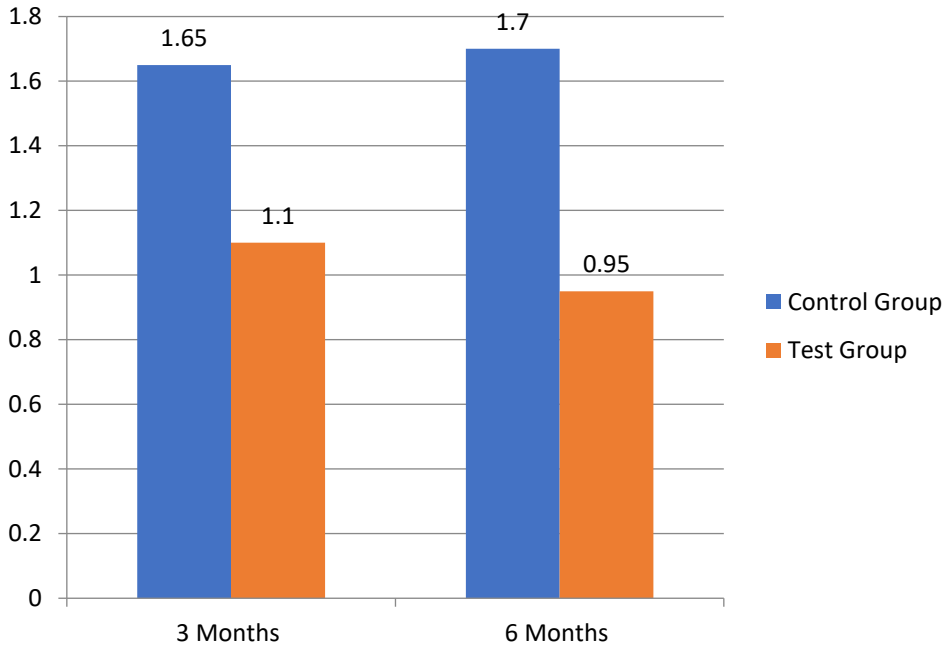
Graph 10: The intragroup change from baseline to 3 months and 6 months

INTERGROUP COMPARIOSN OF CHANGE IN BONE LEVELS (BONE LOSS) BETWEEN THE GROUPS AT DIFFERENT TIME INTERVALS

The mean bone loss at the 3 months was 1.65 in the control group and 1.10 in the test group. At the 6 months time interval the mean bone loss was 1.70 in the control group and 0.95 in the test group.. The intergroup comparison between the groups at 3 months and 6 months was statistically significant when analyzed using independent t test .

		Mean	Std Dev	Std Error	P value	Significance
3 months	Control Group	1.650	0.883	0.279	0.021	Significant
	Test Group	1.100	0.994	0.314		
6 Months	Control Group	1.700	1.159	0.366	0.001	Significant
	Test Group	0.950	1.116	0.353		

Table 11: The intergroup comparison between the groups at 3 months and 6 months



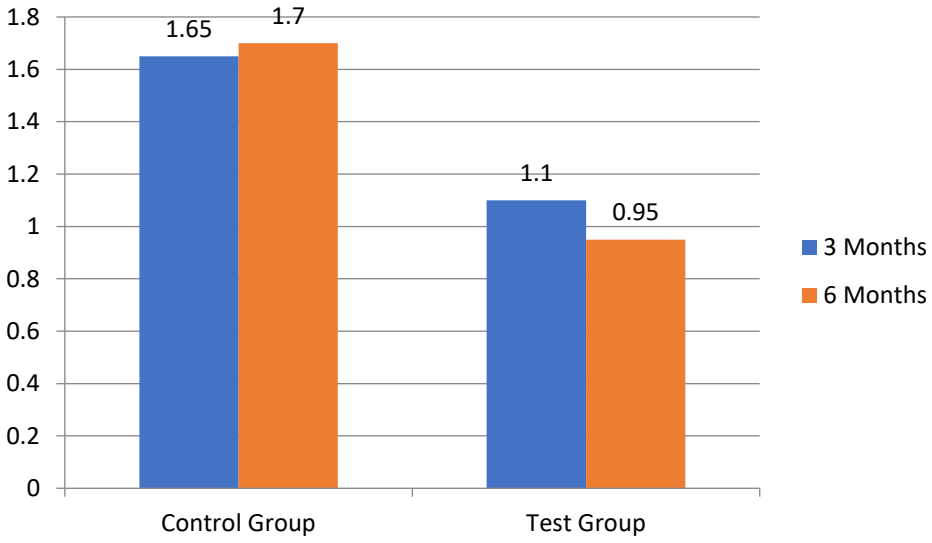
Graph 11: The intergroup comparison between the groups at 3 months and 6 months

INTRAGROUP COMPARIOSN OF CHANGE IN BONE LOSS) BETWEEN THE GROUPS AT DIFFERENT TIME INTERVALS

The mean bone loss at the 3 months was 1.65 in the control group and 1.10 in the test group. At the 6 months time interval the mean bone loss was 1.70 in the control group and 0.95 in the test group.. The intragroup change from 3 months to 6 months was statistically non-significant

	3 Months	6 Months	P value
Control Group	1.95±0.68	1.90±1.28	0.975(Non- Sig)
Test Group	3.00±1.05	3.15±1.49	0.969(Non-Sig)

Table 12: The intragroup change from 3 months to 6 months



Graph 12: The intragroup change from 3 months to 6 months

The present study was designed to evaluate the clinical effectiveness of PRF with and without LLLT in the treatment of intra-bony defects. The results of the study were analysed on the basis of regeneration of the periodontium through the evaluation of clinical and radiographical parameters of periodontal regeneration, such as PI,GI,PPD, CAL and the radiographic defect depth at baseline, 3 months and 6 months after surgical management with the help of a graduated grid.

Periodontitis is a multifactorial chronic inflammatory disease of the periodontium characterised by breakdown of the periodontal soft and hard tissues. Impaired balance between the subgingival microbiome and the immune system, modified by lifestyle, genetic and systemic health factors, leads to the development and progression of the disease.[1] Inflammation of the periodontium may result from many causes (e.g., bacteria, trauma). However, most forms of periodontal diseases result from the accumulation of tooth adherent microorganisms.[54-56] Influential risk factors for the initiation and progression of chronic periodontitis may include the presence of specific subgingival bacteria, use of tobacco and its products, systemic diseases and age. The primary etiology is thought to be bacterial plaque, which can initiate destruction of the gingival tissues and periodontal attachment apparatus.[52,53]

Loss of alveolar bone is one of the characteristic trait of periodontal disease and is generally considered to represent the anatomical sequela to the apical spread of periodontitis. The extent and the severity of alveolar bone loss are usually analysed by a combination of radiographic and clinical means and are important adjuncts to the clinician in the diagnosis, treatment planning, and assessment of prognosis of the periodontal patient. The presence of periodontal osseous lesions relates to the associated loss of tooth support, to the site specificity of periodontal destruction, and to the possibility that ecological niches (deep pockets and furcation involvement) associated with some osseous lesions may represent site-specific risk factors or indicators for disease progression.[57] Classifications of osseous defects were made to consider appropriate diagnosis and formulate considerate treatment plan. The classifications are generally based upon specific morphological criteria and

are aimed at guiding clinicians with their diagnosis, treatment, and prognosis. The first level of classification differentiates between suprabony defects, infrabony defects, and interradicular or furcation defects.[57] According to the classification by ***Goldman & Cohen (1958)***, suprabony defects are those where the base of the pocket is located coronal to the alveolar crest. Infrabony defects, on the other hand, are defined by the apical location of the base of the pocket with respect to the residual alveolar crest. Infrabony defects are of two types: intrabony defects and craters. Intrabony defects are defects where infrabony component involves a single tooth, while in craters the defect involves two adjacent root surfaces to a similar extent. Intrabony defects have been further classified according to their morphology in terms of residual bony walls or width of the defect around the tooth. Three-wall, two-wall and one-wall defects have been defined based on the number of residual alveolar bone walls. Frequently, intrabony defects present a complex anatomy consisting of a three-wall component in the most apical portion of the defect, and two- and/or one-wall components in the more superficial portions. Such defects are frequently referred to as combination defects. Hemiseptal defects, that is, vertical defects in the presence of adjacent roots and where half of a septum remains on one tooth, represent a special case of one wall defects.[58]

Therapeutic approaches for periodontal pathologies fall into two major categories: 1) anti-microbial treatment, which is suggested to pause the progression of periodontal attachment loss by acting over the microbial etiologic factors; and 2) regenerative therapy, which includes anti-infective treatment and is intended to restore structures destroyed by disease. Essential to both treatment approaches are essential for periodontal therapy and maintainence.[59] When the periodontium is damaged by inflammation or as a result of surgical treatment, the defect heals either through periodontal regeneration or repair. In periodontal regeneration, healing occurs through the reconstitution of a new periodontium, which involves the formation of alveolar bone, functionally aligned periodontal ligament, and new cementum. Alternatively, repair due to healing by replacement with epithelial and/or connective tissue that matures into various nonfunctional types of scar tissue is termed new attachment. Histologically, patterns of repair include long

junctional epithelium, ankylosis, and/or new attachment. Although the stability of periodontal repair is not clear, the ideal goal of periodontal surgical therapy is periodontal regeneration.[100] ***Melcher* (1976)**[60] suggested that the cells that repopulate the root surface after periodontal surgery determine the nature of the attachment that will form. Following flap elevation, the instrumented root surface can be repopulated by epithelial cells, gingival connective tissue cells, bone cells and periodontal ligament cells. Under normal healing conditions, epithelial cells rapidly migrate in an apical direction to reach the most apical portion of the instrumentation, forming a long junctional epithelium[61-64] and preventing the formation of a new attachment. The proliferation of connective tissue (CT) may result in connective tissue adhesion. With the predominance of bone cells (B), there may be root resorption, ankylosis (although this is relatively uncommon in humans when compared with animal models), or both. With the ingress of periodontal ligament (PDL) and perivascular cells from the bone, a regenerated periodontium with new cementum develops.[94] Guided tissue regeneration membranes are utilised for the proliferation of periodontal ligament cells. The barrier membrane creates a space and facilitates the proliferation of angiogenic & osteogenic cells from the marrow space into that defect without interferences by fibroblasts.[97-98] ***Gottlow (1993)*** classified[99] the membranes into 3 groups

1.First generation (Non resorbable)

a. Ethyl cellulose (Millipore filter)

b. Expanded Polytetra-fluoro ethylene (e PTFE) membrane (Goretex)

c. Nucleopore membrane

d. Rubber dam

2.Second Generation (resorbable)

a. Collagen membrane.

b. Polylactic acid membrane. (GUIDOR)

c. Vicrylmesh (polyglactin 910)

d. Cargile membrane.

e. Oxidized cellulose.

f. Hydrolysable polyester.

3.Third Generation Bio resorbable matrices with growth factors.

Numerous regenerative materials such as bone grafts, PRP , PRF membranes, soft tissue grafts are used for the therapeutic regenerative procedures.

There have been several therapeutic grafting modalities assessed for restoring the osseous defects. Bonegrafts are further classified as: Autografts are bone from the same individual such as intra-oral autogenous bone grafts procured from the maxillary tuberosity, edentulous alveolar areas, healing bony wound, extraction sites, and mental and retro-molar areas. Extra-oral autografts harvested from the iliac cancellous bone and marrow provide a great osteogenic potential, Inducing cementogensis, bone regeneration and fibres reattachment.[95] Allografts are bone from a different individual of the same species such as Frozen, Freeze-dried and Freeze-dried demineralized. The allograft induced bone formation in nonorthotropic sites, presumable due to the influence of bone-inductive proteins called BMPs.[96] Xenografts are bone from a different species such as e Bovine-Derived Xenograft (BDX) is a xenograft consisting of deproteinized, sterilized bovine bone with 75%–80% porosity and acrystal size of approximately 10 mm in the form of cortical granules few examples are Bio-Oss® (Osteohealth Co., Shirley, NY) andOsteograf/N® (CeraMed Dental, LLC, Lakewood, CO). The Inorganic Porcine-Derived Bone Xenograftis a natural replicate of autologous bone, conserves the same intimate structures (matrix and porous form) and presents a high osteoconductive activity.[95] Ideal Requisites of Bone Grafts are[95]:-

• Osteoinductive property

• Non-toxic

• Resistant to infection

• No root resorption or ankylosis

• Non-antigenic and biologic compatibility

• Easily adaptable and available

• Predictability

• Strong and resilient

• Require minimal surgical intervention

• Rapid vascularization

• Should stimulate new attachment and be able to trigger osteogenesis

Accoding to Ellegaard et al. (1973, 1974, 1975, 1976) and Nielsen et al. (1980, 1981) reported that grafting materials in periodontal bony defects may be used according to properties such as Osteoproliferative or osteogenetic, Osteoconductive, Osteoinductive and osteopromotive.[65-68] Osteoproliferative (osteogenetic) refers to where new bone is formed by bone-forming cells contained in the grafted material. Osteoconductive is where the grafted material does not contribute to new bone formation but serves as a scaffold for bone formation originating from adjacent host bone. Osteoinductive property refers to where bone formation is induced in the surrounding soft tissue immediately adjacent to the grafted material. When the grafted material lacks osteoinductive qualities but nonetheless increases osteoinduction by encouraging bone development, it is known as osteopromotion. [65-68]

According to Kiran NK and colleagues (2011) the role of platelet concentrates in regeneration was proven way back in the 1970s,[69]directing to the fact that it is a reservoir of growth factors that are responsible for neovascularization, collagen synthesis, cell division, cell differentiation, induction, and migration of other cells to the site of injury.[70]Arguements attributed to the various components and types of platelet-rich concentrate preparations, the very first classification was proposed by ***Dohan Ehrenfest et al.,*** 2009,[70]which is now widely accepted. The classification is simple and is based on the presence or absence of leukocytes and the density of fibrin architecture in platelet concentrates it can be divided into the following four main types, i.e.,[34]

- Pure platelet-rich plasma
- Pure platelet-rich fibrin (PRF)
- Leukocyte and platelet-rich plasma
- Leukocyte and PRF

Fibrin glue or PRP, the first platelet concentrate was described in 1970 which was formed by polymerizing fibrinogen with thrombin and calcium. It was originally prepared using donor plasma; however, because of the low concentration of fibrinogen in plasma, the stability and quality of fibrin glue was low. These adhesives were generally obtained autologously from the patient or were obtained commercially, the latter carrying a small risk of disease transmission and allergic reactions due to presence of bovine thrombin.[38] Hence, development of PRF is a second generation platelet concentrate which is an improvement over traditionally prepared PRP. PRF is an immune and platelet concentrate collecting on a single fibrin membrane, containing all the constituents of a blood sample which are favours healing and regeneration.[72]

PRF was prepared in accordance with the protocol developed by ***Choukroun et al.(2006)***[37] PRF was prepared by collecting Intra-venous blood from the antecubital vein of the patient prior to the surgery in a 10-ml sterile PRF tube and immediately centrifuged in a centrifugation machine at 3000 rpm for 10 minutes which resulted in the separation of blood into a structured fibrin matrix in the middle of the tube, just between the red corpuscles at the bottom and acellular at the top. The acellular RBCs corpuscles base using sterile tweezers and scissors. The junction of PRF to the RBC layer was preserved as this region is supposed to be the richest in all the growth factors which was further secured with PRF in the form of a membrane.[46] This second generation biomaterial appears to be like an autologous cicatricial matrix, which is neither like fibrin glue nor like a classical platelet concentrate. It is simply centrifuged blood without addition of any external biomaterial.[37] PRF consists of a fibrin matrix polymerized in a tetra molecular structure, with incorporation of platelets, leucocytes, cytokines, and circulating stem cells.[37,73] Clinical studies suggest that PRF would be a favourable matrix for the development of a coherent healing, without any inflammatory excess.

PRF in the form of a platelet gel can be used in conjunction with other regenerative biomaterials such as bone grafts, which has several advantages, such as promoting wound healing, bone growth and maturation, wound sealing, and haemostasis, and imparting better handling properties to graft materials.[74]

In 1917, Albert Einstein introduced the theory of stimulated emission [81]. The laser was first described by Gordon Gould(1959), a Columbia University graduate student. Theodore Maim (1960)an created the first functional laser at Hughes Research Laboratories [82]. The first gas laser and first continuously operating laser: Javan et al.(1961).[82] The first device was introduced in 1960 by Maiman.[86] "LASER" known as Light Amplification by Stimulated Emission of Radiation, can be operated in the following modes[29]

• Continuous mode: as long as the foot switch is pressed, a single power level of a beam is released.

• Gated pulse mode (physical gating of the beam): periodic alteration for laser energy.

• Free running pulsed mode (property of the active medium): significant energy emission for a few microseconds, followed by a considerable period when the laser is turned off.

Nd-YAG laser, erbium:yttrium aluminum garnet (Er:YAG), CO2, erbium chromium:yttrium scandium gallium garnet, holmium:yttrium aluminum garnet and diode laser are the kind of lasers that are frequently in use. These are generally applied for soft-tissue and hard-tissue procedures like[29]

- Non-surgical periodontal therapy
- Gingival soft tissue procedures
- Hard tissue procedures
- Surgical periodontal therapy
- Photobiomodulation therapy
- Antimicrobial photodynamic therapy

Lasers have been classified in many ways such as:[102-103]

I. According to the wavelength (nanometers)

1. UV (ultraviolet) range – 140 to 400 nm

2. VS (visible spectrum) – 400 to 700 nm

3. IR (infrared) range – more than 700 nm Most lasers operate in one or more of these wavelength regions.

II. Broad classification

1. Hard laser (for surgical work)

i. CO2 lasers (CO2 gas)

ii. Nd:YAG lasers (Yttrium-aluminium-garnet crystals dotted with neodymium)

iii. Argon laser (Argon ions)

2. Soft laser (for biostimulation and analgesia)

i. He-Ne lasers

ii. Diode lasers

III. According to the delivery system

i. Articulated arm (mirror type)

ii. Hollow waveguide

iii. Fiber optic cable

According to the type of active medium used :

a) Gas,
b) solid,
c) semi-conductor or dye lasers

The Nd:YAG laser, which has a pulsed mode and a wavelength of 1064 nm, is used to ablate soft-tissue lesions. 10,600 nm is the wavelength of the gated or continuous mode of the CO2 laser. It is recommended for soft-tissue incision, ablation, de-epithelialization, and periodontal surgical procedures due to its minimal tissue penetration of 0.03 - 0.1 mm.[87] The wavelengths of Er:YAG and Er-Cr:YSGG is 2940 nm and 2780 nm, respectively. They are mostly employed in cavity design, caries removal, and endodontic root canal preparation. Er-Cr:YSGG can vaporize bone without charring it or changing the calcium-phosphorus ratio.[87] The diode laser is the one most frequently

used in periodontal therapy. Most of these gallium-arsenide lasers are used in the application for soft-tissue procedures and have a wavelength of 904 nm.

As described by Hamblin and co-workers (2017) the low level laser therapy used in periodontology in non-surgical treatment as for photobiomodulation therapy. Photobiomodulation therapy includes emission of the radiation in the visible or near-infrared range (630 - 980 nm) and have significant effects on non-surgical periodontal treatment since they promote to reduction in gingival inflammation and have a photobiomodulatory effect, which is demonstrated by a decrease in marker phenotypes linked to activated macrophages, reactive nitrogen species, and pro-inflammatory cytokines [83].

Biomodulation by LASER or cold Lasing causes the activation of intracellular or extracellular photo-absorbable molecules, which therefore stimulates the intra-cellular signalling through cell signalling pathways such as p38, MAPK/ERK pathways which activates the osteoblastic differentiation activity, followed by BMP/ SMAD signalling pathways, thereby promoting osteoblastic proliferation.[78-79] LLLT further promotes the entry of β-Catenin into the nucleus and thus it upregulates the Wnt pathway, which further stimulates osteoblastic differentiation initiating bone formation and inhibiting osteoclastic differentiation, causing the inactivation of bone resorption. Thus, LLLT of the bone has been thought to be efficinet in increasing the osteogenic properties, bone repair and promoting wound healing the osteoblastic differentiation and proliferation.[80]

In the present study, 20 patients fulfilling the inclusion and exclusion criteria were randomly divided into the Control Group having patients undergoing open flap debridement with PRF placement at the area of intrabony defect and Test Group with patients undergoing open flap debridement along with biomodulation using LLLT and PRF placement at the site of defect. The patients were recalled 3months & 6 months post operatively and results were recorded and analysed for statistical analysis. The parameters that were assessed are at baseline are PI,GI,PPD,CAL and Intrabony defect viewed with the help of IOPA with grid. At the end of the study, the entire data was collected and subjected to statistical analysis and interpretation for final

results.The mean plaque score in the study at the baseline was 1.370 in the control group and 1.210 in the test group. At the 3 months time interval the mean plaques score was 0.690 in the control group and 0.900 in the test group. At 6 months the mean plaque score was 0.75 in the control group and 0.98 in the test group as depicted in table 1.The mean plaque score at the baseline 1.370 in the control group and 1.210 in the test group . At the 3 months time interval the mean plaques score was 0.690 in the control group and 0.900 in the test group. At 6 months the mean plaque score was 0.75 in the control group and 0.98 in the test group. , The intragroup change from baseline to 3 months and 6 months was statistically significant but change between 3 months and 6 months was statistically non-significant as seen in table 2. The mean gingival score at the baseline 1.360 in the control group and 1.390 in the test group. At the 3 months time interval the mean gingival score was 0.970 in the control group and 0.910 in the test group. At 6 months the mean gingival score was 0.772 in the control group and 0.790 in the test group. The intragroup change from baseline to 3 months and 6 months was statistically significant but change between 3 months and 6 months was statistically non-significant as seen in table 4. The reduction in the PI and GI scores intergroup and intragroup may be due to the ***Hawthrone Effect*** as described by Harrell, 2019[85].

The mean probing depth in this study was recorded at the baseline 7.20 in the control group and 8.30 in the test group . At the 3 months time interval the mean probing depth was 4.35 in the control group and 5.60 in the test group. At 6 months the mean probing depth was 4.35 in the control group and 5.35 in the test group as seen in table 5. At 6 months the mean probing depth was 4.35 in the control group and 5.35 in the test group. The intragroup change from baseline to 3 months and 6 months was statistically significant but change between 3 months and 6 months was statistically non-significant as shown in table 6.

The clinical parameter i.e. gain in CAL is a more reliable marker for periodontal regeneration to analyse the success of periodontal surgeries. In the study mean CAL at the baseline 5.20 in the control group and 6.20 in the test group . At the 3 months time interval the mean CAL was 2.30 in the

control group and 3.10 in the test group. At 6 months the mean CAL was -2.25 in the control group and 3.30 in the test group as shown in table 7. This indicates the significant clinical reduction by the test protocol of LLLT site modulation. The lack of statistical significance is due to the large standard deviation in the results. The results in this study correlate with the results in the study done by Pradeep et al(2012)[75] which showed a CAL gain of 3.31 ± 1.76 mm after 9 months.

The mean CAL at the baseline 5.20 in the control group and 6.20 in the test group . At the 3 months time interval the mean CAL was 2.30 in the control group and 3.10 in the test group. At 6 months the mean CAL was 2.25 in the control group and 3.30 in the test group. The intragroup change from baseline to 3 months and 6 months was statistically significant but change between 3 months and 6 months was statistically non-significant as seen in table 8.

The results in the current study also coincided with the research conducted by Joseph et al(2012)[76] which showed a CAL gain of 3.33 ± 0.35 mm of CAL after 12 months, when PRF was used as the sole grafting material in the management of intrabony defect management, which is almost comparable to this study results. The CAL gain was significantly higher in the current study when compared with the mean CAL gain reported in a systematic review by Shah et al(2014)[77] who reported only 0.95 mm of CAL gain when PRF is utilized as a sole grafting material. The CAL gain in the test group was comparatively more than the control group, implying a positive contribution by the cell stimulative and proliferative capacity of LLLT with the adjunctive utilization of IMP along with the three-dimensional scaffold PRF within a simplified papilla preservation access flap.

In a a systematic review and meta-analysis by Richard J. Miron et al(2021)[84] from 551 articles identified, 27 RCTs were included in the study. Several treatment methods were included and comparison were made.The use of OFD/PRF statistically significantly reduced PD and improved CAL and RBF when compared to OFD. No clinically significant differences were reported when OFD/BG was compared to OFD/PRF. Further, PRF to OFD/BG led to significant improvements in CAL and RBF. No differences were seen

between any of the following groups (OFD/BM, OFD/PRP, and OFD/EMD) when compared to OFD/PRF. No statistically significant results were reported when PRF was added to OFD/EMD. The addition of all three of the following biomolecules (metformin, bisphosphonates, and statins) to OFD/PRF led to statistically significant improvements of PD, CAL, and RBF.

The results reported in the present study in terms of reduction in PD and gain in CAL values confirm the findings as reported in the studies conducted by Lindhe et al.,[88] Lindhe et al.,[90] and Sculean et al.[89] For the laser-assisted pocket therapy, the reduction in PD and gain in CAL values were found to be consistent with those obtained in the studies of Moritz et al.,[15] Borrajo et al.,[91] Caruso et al.,[92] and Kamma et al.[16] The changes seen with laser therapy might be attributed to the fact that the adjacent inflammatory cell infiltrates might have been removed. In addition, the low-dose radiation that scatters into the surrounding tissues might possess a therapeutic effect on the healing process.[93] Furthermore, LLLT might have resulted in improved proliferation of the fibroblasts and their adhesion to the root surfaces, leading to CAL gain.[86] There is less collagen remodeling, faster healing, and minimal scar tissue with laser-assisted pocket therapy, which might explain why less gingival recession takes place in the said situations.[86] Diode lasers also have antimicrobial effects and detoxification properties. They have a high bactericidal potential against periodontal bacteria.[92]

From the results of the study, it is observed that the control group (OFD+PRF) and the test group (OFD+PRF+LLLT) both had significant clinical and radiological improvements from baseline to six months post-intervention. The mean bone loss at the 3 months was 1.65 in the control group and 1.10 in the test group. At the 6 months time interval the mean bone loss was 1.70 in the control group and 0.95 in the test group. The intergroup comparison between the groups at 3 months and 6 months was statistically significant when analysed using independent t test as shown in table 11. The mean bone loss at the 3 months was 1.65 in the control group and 1.10 in the test group. At the 6 months time interval the mean bone loss was 1.70 in the

control group and 0.95 in the test group. The intragroup change from 3 months to 6 months was statistically non-significant as seen in table 12.

From the results of the study, it is observed that the OFD+PRF group and the OFD+ LLLT+PRF group both had significant improvement in the clinical and radiological improvements from baseline to six months post-intervention, however in the inter-group comparison, the differences between the groups were not statistically significant.

The aim of the present study was to compare the possible outcome in relation to clinical and radiographical parameters in the two groups of patients with intrabony defects: the first group undergoing PRF and second group undergoing PRF with low level laser therapy as an adjunct.

Within the limits of this study, it can be concluded that both the control group (OFD+PRF) and test group (OFD+LASER+PRF) showed an overall improvement in the clinical and radiographic parameters accessed in the study such as PPD, CAL and bone levels. Better results were obtained in the control group when compared to the results obtained in the test group, however the difference between the two groups was statically non-significant.

Further studies with larger sample size and longer follow-up period are required to corroborate the results obtained in the current study.

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ANNEXURE - 1

Institutional Ethical Committee

BABU BANARASI DAS UNIVERSITY
BBD COLLEGE OF DENTAL SCIENCES, LUCKNOW

BBD UNIVERSITY

BBDCODS/IEC/09/2022 **Dated: 16th September, 2022**

Communication of the Decision of the Xth Institutional Ethics Sub-Committee Meeting

IEC Code: 30

Title of the Project: Comparative Evaluation Of The Efficacy Of PRF With And Without Low-Level Laser Therapy In The Treatment Of Intra-Bony Defects: A Clinico-Radiographic Study.

Principal Investigator: Dr Akriti Jha **Department:** Periodontology

Name and Address of the Institution: BBD College of Dental Sciences Lucknow.

Type of Submission: New, MDS Project Protocol

Dear Dr Akriti Jha,

The Institutional Ethics Sub-Committee meeting comprising following members was held on 15th September, 2022.

1.	Dr. Lakshmi Bala Member Secretary	Prof. and Head, Department of Biochemistry
2.	Dr. Praveen Singh Samant Member	Prof. & Head, Department of Conservative Dentistry & Endodontics
3.	Dr. Jiji George Member	Prof. & Head, Department of Oral Pathology & Microbilogy
4.	Dr. Amrit Tandan Member	Professor, Department of Prosthodontics and Crown & Bridge
5.	Dr. Rana Pratap Maurya Member	Reader, Department of Orthodontics & Dentofacial Orthopaedics

The committee reviewed and discussed your submitted documents of the current MDS Project Protocol in the meeting.
The comments were communicated to PI, thereafter it was revised.

Decisions: The committee approved the above protocol from ethics point of view.

Forwarded by:

Lakshmi Bala 16/09/22

Prof. Dr. Puneet Ahuja
Principal
BBD College of Dental Sciences
BBD University, Lucknow

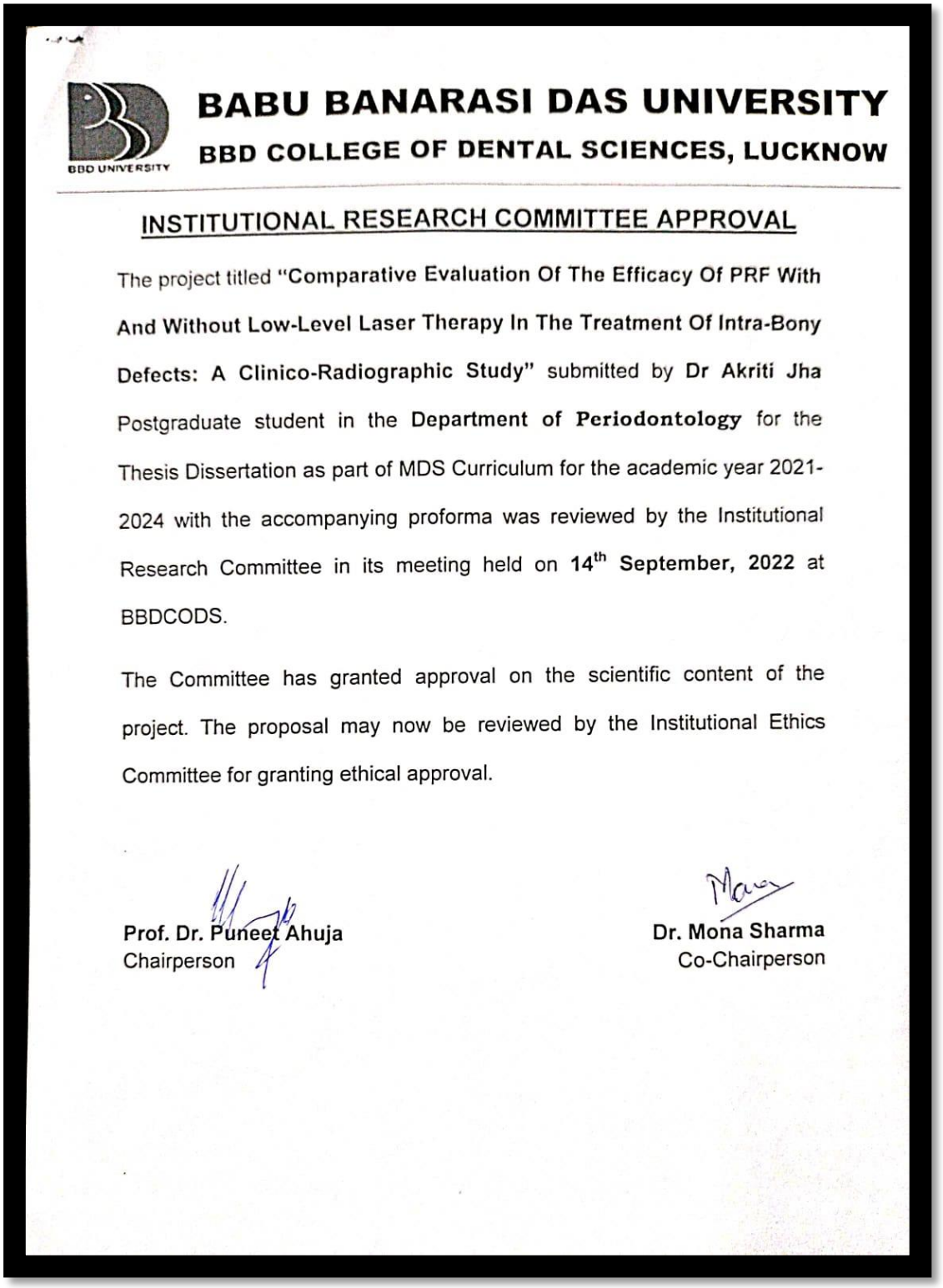
PRINCIPAL
Babu Banarasi Das College of Dental Sciences
(Babu Banarasi Das University)
BBD City, Faizabad Road, Lucknow-226028

Dr. Lakshmi Bala
Member-Secretary
Institutional Ethics Sub-Committee (IEC)
BBD College of Dental Sciences
BBD University, Lucknow

Member-Secretary
Institutional Ethic Committee
BBD College of Dental Sciences
BBD University
Faizabad Road, Lucknow-226028

ANNEXURE – 2

Institutional research committee approval certificate



BABU BANARASI DAS UNIVERSITY

BBD COLLEGE OF DENTAL SCIENCES, LUCKNOW

INSTITUTIONAL RESEARCH COMMITTEE APPROVAL

The project titled **"Comparative Evaluation Of The Efficacy Of PRF With And Without Low-Level Laser Therapy In The Treatment Of Intra-Bony Defects: A Clinico-Radiographic Study"** submitted by **Dr Akriti Jha** Postgraduate student in the **Department of Periodontology** for the Thesis Dissertation as part of MDS Curriculum for the academic year 2021-2024 with the accompanying proforma was reviewed by the Institutional Research Committee in its meeting held on **14th September, 2022** at BBDCODS.

The Committee has granted approval on the scientific content of the project. The proposal may now be reviewed by the Institutional Ethics Committee for granting ethical approval.

Prof. Dr. Puneet Ahuja
Chairperson

Dr. Mona Sharma
Co-Chairperson

ANNEXURE -3

Consent Form

Babu Banarasi Das College of Dental Sciences

(Babu Banarasi Das University)

BBD City, Faizabad Road, Lucknow – 227105 (INDIA)

Consent Form (English)

Title of the Study : Comparative evaluation of the efficacy of PRF with and without low-level laser therapy in the treatment of intra-bony defects: A clinic-radiographic study

Study Number……..
Subject's Full Name…….
Date of Birth/Age ……
Address of the Subject…….
Phone no. and e-mail address……
Qualification ……
Occupation: Student / Self Employed / Service / Housewife/Other (Please tick as appropriate)
Annual income of the Subject……
Name and of the nominees(s) and his relation to the subject (For the purpose of
compensation in case of trial related death).

1. I confirm that I have read and understood the Participant Information Document dated
……..for the above study and have had the opportunity to ask questions. **OR** I have beenexplained the nature of the study by the Investigator and had the opportunity to ask questions.

2. I understand that my participation in the study is voluntary and given with free will without any duress and that I am free to withdraw at any time, without giving any reason and without my medical care or legal rights being affected.

3. I understand that the sponsor of the project, others working on the Sponsor's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. However, I understand that my Identity will not be revealed in any information released to third parties or published.

4. I agree not to restrict the use of any data or results that arise from this study provided sucha use is only for scientific purpose(s).

5. I permit the use of stored sample (tooth/tissue/blood) for future research. **Yes [ ] No [ ]**

   Not Applicable [ ]

6. I agree to participate in the above study. I have been explained about the complications andside effects, if any, and have fully understood them. I have also read and understood the participant/volunteer's Information document given to me.

   Signature (or Thumb impression) of the Subject/Legally Acceptable Representative:……..

   Signatory's Name……. Date …….

   Signature of the Investigator……. Date……..

   Study Investigator's Name..... Date……..

   Signature of the witness…… Date……..

   Name of the witness……

   Received a signed copy of the PID and duly filled consent form

   Signature/thumb impression of the subject or legally

   Date…….

ANNEXURE - 4

PID Form

Babu Banarasi Das College of Dental Sciences

(Babu Banarasi Das University)

BBD City, Faizabad Road, Lucknow – 227105

(INDIA)

Participant Information Document (PID)

1. Study Title

Comparative evaluation of the efficacy of PRF with and without low-level laser therapy in the treatment of intra-bony defects: A clinico-radiographic study.

2. Invitation Paragraph

You are being invited to take part in a research/trial study. Before you decide it is important for you to understand why the research/study is being done and what it will involve. Please take time to read the following information carefully and discuss it with friends, relatives and your treating physician/family doctor if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

3. What is the purpose of the study?

The aim of the study is to compare the possible outcome in relation to clinical and radiographical parameters in the two groups of patients with intrabony defects: The first group undergoing PRF and the second group undergoing PRF with low-level laser therapy as an adjunct.

4. Why have I been chosen?

You have been chosen as you fulfil the criteria for the study.

5. Do I have to take part?

It is up to you to decide whether or not to take part. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at anytime and without giving a reason.

6. What will happen to me if I take part?

You will have to visit four to five times. In the first visit complete scaling and root planning will be done. In the next visit open flap debridement will be done under local anesthesia. PRF will be made from your blood and will be grafted into the defect site. Flaps will be then repositioned and sutured with 3-0 silk sutures using an interrupted technique followed by periodontal dressings. You will be recalled for follow up after seven days, then after 3 months and 6 months preoperatively and results will be analyzed for statistical analysis. As a volunteer, your responsibility will be to arrive on time.

7. What do I have to do?

There will be certain changes in the dietary intake with few other precautionary measures and you will be expected to follow that.

8. What is the procedure that is being tested?

20 patients with intrabony defect will be treated under 2 groups, group A- Containing 10 patients with intrabony defect will be treated with open flap debridement and PRF will be grafted at the defect site. Group B- containing 10 patients with intrabony defect will be treated with open flap debridement and low-level laser therapy followed by PRF will be grafted on the defect site.

9. What are the interventions for the study?

Pre-surgical IOPAR with a grid and complete blood investigations will be performed. Surgical: The intrabony defect will be treated with OFD along with low-level laser therapy and PRF will be grafted at the defect site and the flaps will be approximated with 3-0 silk sutures followed by periodontal dressing. Bone gain will be evaluated at a baseline of 3 months and 6 months post operatively. Post-surgical: medications will be prescribed such as antibiotics and NSAIDS.

10. What are the side effects of taking part?

There are no possible side effects of PRF and low-level laser therapy except some pain and discomfort which may last not more than 2 weeks. In case if any major issue arises please report immediately to the doctor.

11. What are the possible disadvantages and risks of taking part?

There are no possible disadvantages and risk of the study. The regenerative material (PRF) used will be extracted from your own blood and the low-level laser therapy have undergone rigorous research and development and has no reported side effects.

12. What are the possible benefits of taking part?

By taking part in this study you will be receiving a better treatment option at a lesser discomfort. PRF and low-level laser therapy will produce good results since they have growth factors and antimicrobial properties in them.

13. What if new information becomes available?

Sometimes during a research project, new information becomes available about the research being studied. If this happens, your researcher will tell you about it and discuss with you whether you want to continue in the study. If you decide to withdraw, your researcher/investigator will make arrangements for your

withdrawal. If you decide to continue in the study, you may be asked to sign an updated consent form.

14. What happens when the research study stops?

If the study finishes/stops before the stipulated time, this should be explained to the patient/volunteer.

15. What if something goes wrong?

If any severe adverse event occurs, or something goes wrong during the study, the complaints will be handled by the doctors expertising in the field at BBDCODS opd.

16. Will my taking part in this study be kept confidential?

Yes, it will be kept confidential. Your name, address or any other personal information will not be shared outside the BBDCODS.

17. What will happen to the results of the research study?

The results of the study will remain as the property of the institute, BBDCOS. However, the identity of the participants will not be disclosed.

18. Who is organizing the research?

This research study is organized by the academic institute (BBDCODS).

19. Will the results of the study be made available after study is over?

Yes. If the patient wishes, the result of the study will be made available to him/her.

20. Who has reviewed the study?

The study has been reviewed and approved by the Head of the Department, IEC/IRC of the institution.

21. Contact for further information

Dr. Akriti Jha

Department of Periodontology and Implantology

Babu Banarasi Das College of Dental Sciences.

Lucknow – 226028

Mob: 7080152411

Email: akritijha28@gmail.com

Dr. Laxmi Bala,

Secretary & Member- Institutional Ethics Sub-committee,

Babu Banarasi Das College of Dental Sciences.

Lucknow – 226028

bbdcods.iec@gmail.com

Signature of PI……

Name…….. _____

Date…….. _____

22. Will the results of the study be made available after study is over?

Yes. If the patient wishes, the result of the study will be made available to him/her.

23. Who has reviewed the study?

The study has been reviewed and approved by the Head of the Department, IEC/IRC of the institution.

24. Contact for further information

Dr. Akriti Jha

Department of Periodontology and Implantology

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Lucknow – 226028

Mob: 7080152411

Email: akritijha28@gmail.com

Dr. Laxmi Bala,

Member Secretary,

Babu Banarasi Das College of Dental Sciences.

Lucknow – 226028

bbdcods.iec@gmail.com

Signature of PI……

Name……..

Date…….

ANNEXURE - 5

Babu Banarasi Das College of Dental Sciences

(Babu Banarasi Das University)

BBD City, Faizabad Road, Lucknow – 227105 (INDIA)

Guidelines for Devising a Participant / Legally Acceptable Representative Information Document (PID) in Hindi

1. अध्ययन शीर्षक

"इंट्रा-बोनी दोषों के उपचार में निम्न-स्तरीय लेजर थेरेपी के साथ और बिना पीआरएफ की प्रभावकारिता का तुलनात्मक मूल्यांकन: एक क्लिनिको-रेडियोग्राफिक अध्ययन"।

2. आमंत्रण पैराग्राफ

आपको एक शोध / परीक्षण अध्ययन में भाग लेने के लिए आमंत्रित किया जा रहा है। निर्णय लेने से पहले आपके लिए यह समझना महत्वपूर्ण है कि अनुसंधान / अध्ययन क्यों किया जा रहा है और इसमें क्या शामिल होगा। कृपया निम्नलिखित जानकारी को ध्यान से पढ़ने के लिए समय निकालें और यदि आप चाहें तो दोस्तों, रिश्तेदारों और अपने इलाज करने वाले चिकित्सक / पारिवारिक चिकित्सक के साथ चर्चा करें। हमसे पूछें कि क्या ऐसा कुछ है जो स्पष्ट नहीं है या यदि आप अधिक जानकारी चाहते हैं। यह तय करने के लिए समय निकालें कि आप भाग लेना चाहते हैं या नहीं।

3. अध्ययन का उद्देश्य क्या है?

अध्ययन का उद्देश्य इंट्राबोनी दोषों वाले रोगियों के दो समूहों में नैदानिक

और रेडियोग्राफिक मापदंडों के संबंध में संभावित परिणाम की तुलना करना है: पीआरएफ से गुजरने वाला फर्ड समूह और एक सहायक के रूप में निम्न-स्तरीय लेजर थेरेपी के साथ पीआरएफ से गुजरने वाला दूसरा समूह।

4. मुझे क्यों चुना गया है?

आपको अध्ययन के मानदंडों को पूरा करने के रूप में चुना गया है।

5. क्या मुझे भाग लेना है?

यह आप पर निर्भर करता है कि भाग लेना है या नहीं। यदि आप भाग लेने का निर्णय लेते हैं तो आपको यह सूचना पत्र रखने के लिए दिया जाएगा और सहमति पत्र पर हस्ताक्षर करने के लिए कहा जाएगा। यदि आप भाग लेने का निर्णय लेते हैं तो आप अभी भी किसी भी समय और बिना कोई कारण बताए वापस लेने के लिए स्वतंत्र हैं।

6. यदि मैं भाग लेता हूँ तो मेरा क्या होगा?

आपको चार से पांच बार यात्रा करनी होगी। पहली यात्रा में पूरी स्केलिंग और रूट प्लानिंग की जाएगी। अगली यात्रा में स्थानीय संज्ञाहरण के तहत ओपन फ्लैप डिब्रिडमेंट किया जाएगा। पीआरएफ आपके रक्त से बनाया जाएगा और दोष स्थल में ग्राफ्ट किया जाएगा। फ्लैप को तब पीरियडोंटल ड्रेसिंग के बाद एक बाधित तकनीक का उपयोग करके 3-0 रेशम टांके के साथ पुनर्स्थापित और टांका लगाया जाएगा। आपको सात दिनों के बाद अनुवर्ती के लिए वापस बुलाया जाएगा, फिर 3 महीने और 6 महीने के बाद और सांख्यिकीय विश्लेषण के लिए परिणामों का विश्लेषण किया जाएगा। एक स्वयंसेवक के रूप में, आपकी जिम्मेदारी समय पर पहुंचने की होगी।

7. मुझे क्या करना होगा?

कुछ अन्य एहतियाती उपायों के साथ आहार सेवन में कुछ बदलाव होंगे और आपसे इसका पालन करने की उम्मीद की जाएगी।

8. किस प्रक्रिया का परीक्षण किया जा रहा है?

इंट्राबोनी दोष वाले 20 रोगियों का इलाज 2 समूहों के तहत किया जाएगा, समूह ए- जिसमें इंट्राबोनी दोष वाले 10 रोगियों का इलाज खुले फ्लैप डिब्रिडमेंट के साथ किया जाएगा और पीआरएफ को दोष स्थल पर ग्राफ्ट किया जाएगा। इंट्राबोनी दोष वाले 10 रोगियों वाले ग्रुप बी का इलाज खुले फ्लैप डिब्रिडमेंट के साथ किया जाएगा और पीआरएफ के बाद निम्न-स्तरीय लेजर थेरेपी को दोष स्थल पर ग्राफ्ट किया जाएगा।

9. अध्ययन के लिए क्या हस्तक्षेप हैं?

एक ग्रिड और पूर्ण रक्त जांच के साथ पूर्व सर्जिकल आईओपार किया जाएगा। सर्जिकल: इंट्राबोनी दोष का इलाज निम्न-स्तरीय लेजर थेरेपी के साथ ओएफडी के साथ किया जाएगा और पीआरएफ को दोष स्थल पर ग्राफ्ट किया जाएगा और फ्लैप को पीरियडोंटल ड्रेसिंग के बाद 3-0 रेशम टांके के साथ अनुमानित किया जाएगा। हड्डी के लाभ का मूल्यांकन ऑपरेशन के बाद 3 महीने और 6 महीने की आधाररेखा पर किया जाएगा। शल्य चिकित्सा के बाद: एंटीबायोटिक दवाओं और एनएसएआईडीएस जैसी दवाएं निर्धारित की जाएंगी।

10. भाग लेने के दुष्प्रभाव क्या हैं?

कुछ दर्द और असुविधा को छोड़कर पीआरएफ और निम्न-स्तरीय लेजर थेरेपी के कोई संभावित दुष्प्रभाव नहीं हैं जो 2 सप्ताह से अधिक समय तक नहीं रह सकते हैं। यदि कोई बड़ी समस्या उत्पन्न होती है तो कृपया तुरंत डॉक्टर को रिपोर्ट करें।

11. भाग लेने के संभावित नुकसान और जोखिम क्या हैं?

अध्ययन के कोई संभावित नुकसान और जोखिम नहीं हैं। उपयोग की जाने वाली पुनर्योजी सामग्री (पीआरएफ) आपके अपने रक्त से निकाली जाएगी और निम्न-स्तरीय लेजर थेरेपी ने कठोर अनुसंधान और विकास किया है और इसका कोई दुष्प्रभाव नहीं है।

12. क्या होगा यदि नई जानकारी उपलब्ध हो जाती है?

इस अध्ययन में भाग लेने से आपको कम असुविधा पर बेहतर उपचार विकल्प प्राप्त होगा। पीआरएफ और निम्न-स्तरीय लेजर थेरेपी अच्छे परिणाम उत्पन्न करेगी क्योंकि उनमें विकास कारक और रोगाणुरोधी गुण हैं।

13. जब शोध अध्ययन बंद हो जाता है तो क्या होता है?

यदि अध्ययन निर्धारित समय से पहले समाप्त हो जाता है / बंद हो जाता है, तो इसे रोगी / स्वयंसेवक को समझाया जाना चाहिए

14. अगर कुछ गलत हो जाए तो क्या होगा?

यदि अध्ययन के दौरान कोई गंभीर प्रतिकूल घटना होती है, या कुछ गलत हो जाता है, तो शिकायतों को बीबीडीसीओडीएस ओपीडी में क्षेत्र में विशेषज्ञ डॉक्टरों द्वारा संभाला जाएगा।

15. क्या इस अध्ययन में मेरे भाग लेने को गोपनीय रखा जाएगा?

हां, इसे गोपनीय रखा जाएगा। आपका नाम, पता या कोई अन्य व्यक्तिगत जानकारी बीबीडीसीओडीएस के बाहर साझा नहीं की जाएगी।

16. शोध अध्ययन के परिणामों का क्या होगा?

प्रतिभागियों की पहचान किसी भी परिणाम, रिपोर्ट या प्रकाशनों में प्रकट नहीं की जाएगी।

17. शोध का आयोजन कौन कर रहा है?

अध्ययन के परिणाम संस्थान, बीबीडीसीओएस की संपत्ति के रूप में बने रहेंगे। हालांकि प्रतिभागियों की पहचान उजागर नहीं की जाएगी।

18. क्या अध्ययन समाप्त होने के बाद अध्ययन के परिणाम उपलब्ध कराए जाएंगे?

हाँ। यदि रोगी चाहे, तो अध्ययन का परिणाम उसे उपलब्ध कराया जाएगा।

19. अध्ययन की समीक्षा किसने की है?

अध्ययन की समीक्षा की गई है और संस्थान के विभागाध्यक्ष, आईईसी/आईआरसी द्वारा अनुमोदित किया गया है।

20. अधिक जानकारी के लिए संपर्क करें

डॉ. आकृति झा

पीरियडोंटोलॉजी और इम्प्लांटोलॉजी विभाग

बाबू बनारसी दास कॉलेज ऑफ डेंटल साइंसेज।

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सचिव और सदस्य- संस्थागत आचार उप-समिति,

बाबू बनारसी दास कॉलेज ऑफ डेंटल साइंसेज।

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पं. का नाम –

पता -

ईमेल -

टेलीफोन नंबर। -

पीआई के हस्ताक्षर .....

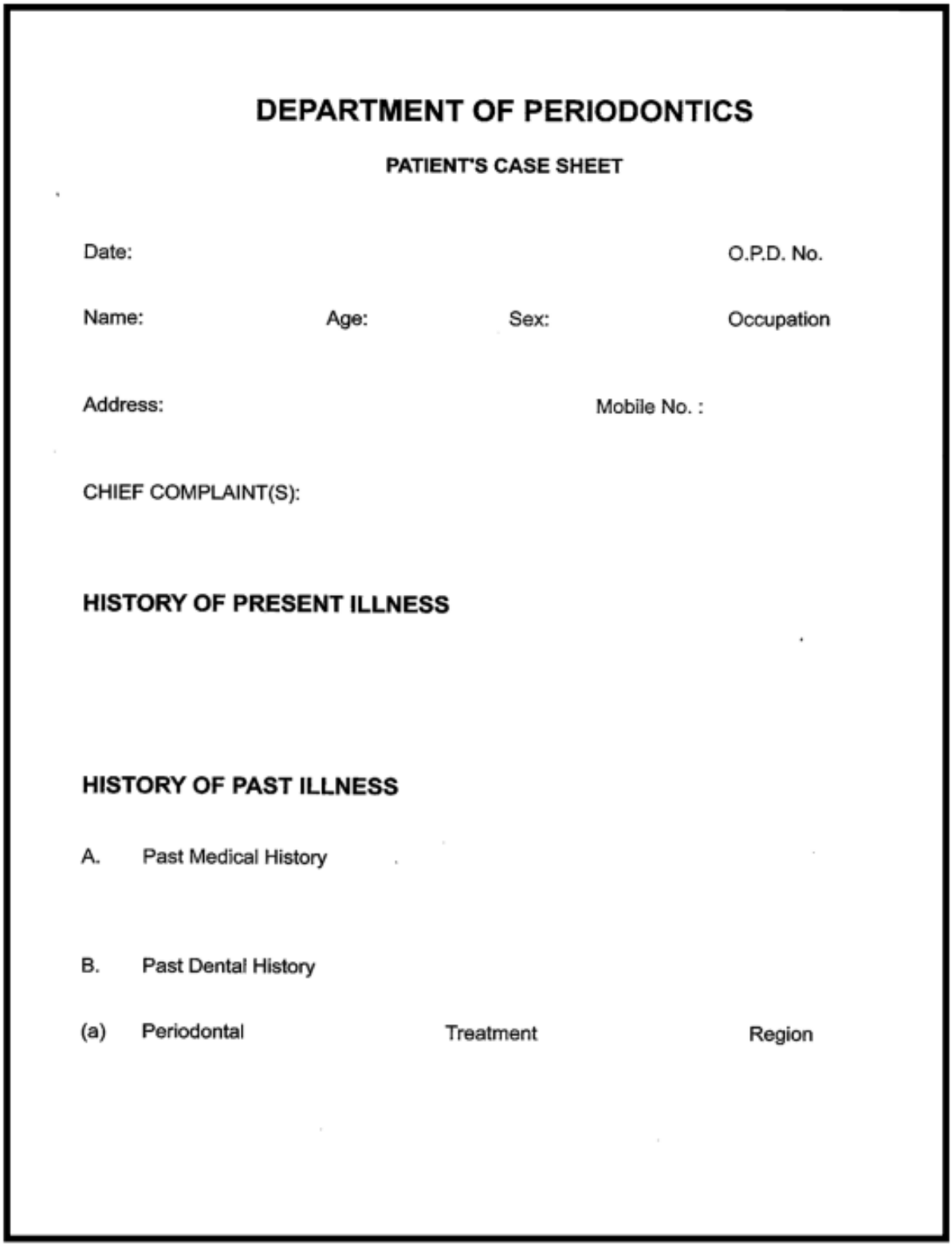
नाम.....

तारीख.....

प्रतिभागी को सूचना पत्र की एक प्रति और हस्ताक्षरित सहमति प्रपत्र दिया जाएगा।

अध्ययन में भाग लेने के लिए धन्यवाद।

ANNEXURE – 6



DEPARTMENT OF PERIODONTICS

PATIENT'S CASE SHEET

Date: O.P.D. No.

Name: Age: Sex: Occupation

Address: Mobile No. :

CHIEF COMPLAINT(S):

HISTORY OF PRESENT ILLNESS

HISTORY OF PAST ILLNESS

A. Past Medical History

B. Past Dental History

(a) Periodontal Treatment Region

Patient's Proforma

(b) **Other dental therapy**

Conservative

Prosthetics

Orthodontics

Oral Surgery

Any Other

C. Present Medical History

(a) General health

1. Bleeding Tendencies
2. Allergy
3. Cardiovascular Diseases
4. Endocrinal Diseases
5. Gastro Intestinal Diseases
6. Neurological Disorder
7. Respiratory Diseases
8. Genito Urinary Diseases
9. Hereditary/Genetic Disorder
10. Puberty/ Pregnancy/ Menopause
11. Any Infectious Disease(s)
12. Medication
13. Any other abnormality

(b) Nutritional Status: i) Well Built /Average /Poor
ii) Non Vegetarian / Vegetarian

D. PRESENT DENTAL HISTORY

(a) **Oral Hygiene Maintenance:** Brush/ Finger/ Stick / Paste/ Powder
Frequency: Once/ Twice/ Thrice
Direction

(b) **HABITS**

1.	Awareness of any Traumatising habits	Yes	No
2.	Grinding of Teeth	Yes	No
3.	Masticatory Muscle Tiredness	Morning	Evening
4.	Biting Habits	Lip/ Tongue/ Cheek/ Misc	
5.	Chewing	Betel/ Tobacco/ Mis.	
6.	Smoking	Beedi/ Cigarette/ Misc.	
7.	Mouth Breathing/ Tongue Thrusting		

CLINICAL EXAMINATION

EXTRA ORAL EXAMINATION

Face

Lips:	Competency
Skin:	Color: Normal or Palor
Neck	Swellings- Unilateral or Bilateral
Jaws:	Symmetry- Antero- Posterior relationship & movements Temporo-Mandibular Joint

INTRA ORAL EXAMINATION:

A. Soft Tissue

Labial & Buccal Mucosa:		Colour, texture
Cheek:		Colour, Stretchability, Consistency
Tongue:		Colour, Size, Mobility, Texture
Floor of the Mouth:		
Palate:	Hard:	Colour, Defect, Depth, Rougae, Tori.
	Soft:	Color, Defect
Vestibule:		
Saliva:		Flow: heavy/ diminished/ Normal Viscosity: thin/thick
Frenum/ Frenii		Number, Size, Attachment
Perio- Endo Problem		

B. Gingival Status

1. Colour
2. Contour
3. Consistency
4. Surface Texture
5. Position
6. Size
7. Exudate

C. Hard Tissue

1. No. of teeth present
2. Hypersensitivity
3. Missing teeth (why, when)
4. Caries / Non-vital
5. Supernumerary
6. Proximal contact relationship
7. Plunger cusp
8. Crown size and Colour
9. Pathologic Tooth Migration
10. Mobility — Grade I / II / III
11. Hypoplasia
12. Occlusion — Angle's Classification : Class I / II / III
    Bite: Normal /Open/ Deep/Cross/Crowding
13. Retained / Impacted
14. Attrition/ Erosion/ Abrasion
15. Furcation Involvement
16. Trauma from Occlusion
17. Halitosis
18. Any dental anatomic factors
19. Calculus - Mild / Moderate / Severe
20. Stains - Mild / Moderate / Severe

DIAGNOSIS

PROGNOSIS

TREATMENT PLAN

EMERGENCY -

PHASE I -

PHASE II -

PHASE III -

PHASE IV -

S.No.	Date	Procedure Done	Next Appointment	Staff Signature

INVESTIGATION

1. ROENTENOGRAPHIC EXAMINATION :

OPG/IOPA/BITE WING/OCCLUSAL

	DESCRIPTION	REGION
1. Lamina dura		
2. Periodontal ligament space		
3. Root form		
4. Bone loss	Vertical	
	Horizontal	
	Infra bony crater	
	Miscellaneous	
5. Periapical pathology		
6. Any other finding		

2. LAB INVESTIGATIONS

Date	Investigation	Result
	BLOOD	
	Hb%	
	RBC	
	TLC	
	DLC	
	ESR	
	Random Sugar	
	Bleeding time	
	Clotting time	
	HbS Ag Status : Positive / Negative	
	HIV Status : Positive / Negative	

DEPARTMENT OF PERIODONTICS
BABU BANARASI DAS COLLEGE OF DENTAL SCIENCES
LUCKNOW

PROFORMA OF PATIENT'S INFORMED CONSENT

I..... son/daughter/wife of..... aged..... years, resident of..... being under the treatment of Dr..... do hereby willfully consent to the performance of a surgical procedure under local anaesthesia for the treatment of ..... (Diagnosis) upon myself / upon..... aged..... years, who is related to me as..... (for e.g. son, daughter, wife etc).

I have been informed regarding the inherent risk involved during and after the surgical procedure and that the success of the treatment cannot be guaranteed. I have signed this consent from voluntarily out of my free will without any compulsion or influence.

Date : Place :

Signature : Time :

(To be signed by parent / guardian in case of minor)

सहमति पत्र

मैं.....पुत्र/पुत्री/पत्नी.....आयु.....वर्ष

निवासी.....

मेरे दंत एवं मुख रोग का उपचार डा. ..... कर रहे हैं।

दंत एवं मसूड़े की शल्य क्रिया के लिए मुख निश्चेतना (Local anesthesia) आवश्यक है।

मुझे पूरी शल्य प्रक्रिया के दौरान होने वाले संभावित खतरों के बारे में ठीक से बता दिया गया है एवं उचार की सफलता के बारे में कोई निश्चितत नहीं है से भी अवगत करा दिया गया है मैं इस सहमति पत्र पर भलीभांति, बिना किसी दवाब के अपनी इच्छानुसार हस्ताक्षर कर रहा हूँ।

दिनांक हस्ताक्षर

स्थान समय

नोट : अवस्यक / नाबालिग होने की अवस्था में अभिभावक के हस्ताक्षर आवश्यक है।

ANNEXURE – 7

STATISTICAL ANALYSIS

The data for the present study was entered in the Microsoft Excel 2007 and analyzed using the SPSS statistical software 23.0 Version. The descriptive statistics included mean, standard deviation frequency and percentage. The level of the significance for the present study was fixed at 5%.

The intergroup comparison will be done using the independent t tests and intragroup comparison will be done using the Repeated Measures ANOVA followed by paired t test The Shapiro–Wilk test was used to investigate the distribution of the data and Levene's test to explore the homogeneity of the variables.

Mean

$$\overline{X} = \frac{\Sigma X}{N}$$

Where:

$\overline{X}$ = the data set mean

$\sum$ = the sum of

X = the scores in the distribution

N = the number of scores in the distribution

Range

$$range = X_{highest} - X_{lowest}$$

Where:

$X_{highest}$ = largest score

X_{lowest} = smallest score

Variance

$$SD^2 = \frac{\Sigma(X - \overline{X})^2}{N}$$

The simplified variance formula

$$SD^2 = \frac{\Sigma X^2 - \frac{(\Sigma X)^2}{N}}{N}$$

Where:

SD^2 = the variance

$\sum$ = the sum of

X = the obtained score

$\overline{X}$ = the mean score of the data

N = the number of scores

Standard Deviation (N)

$$SD = \sqrt{\frac{\Sigma(X - \overline{X})^2}{N}}$$

The simplified standard deviation formula

$$SD = \sqrt{\frac{\Sigma X^2 - \frac{(\Sigma X)^2}{N}}{N}}$$

Where:

SD = the standard deviation

$\sum$ = the sum of

X = the obtained score

$\overline{X}$ = the mean score of the data

N = the number of scores

Independent t-test

Independent t Test can be used to determine if two sets of data are significantly different from each other, and is most commonly applied when the test statistic would follow a normal distribution. The independent samples *t*-test is used when two separate sets of independent and identically distributed samples are obtained, one from each of the two populations being compared

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\left(\frac{(N_1 - 1)s_1^2 + (N_2 - 1)s_2^2}{N_1 + N_2 - 2}\right)\left(\frac{1}{N_1} + \frac{1}{N_2}\right)}}$$

Where X1 =Mean of the first Group, X2 =Mean of the Second Group

Paired t test

$$t = \frac{\bar{x} - 0}{SE(d)} = \frac{\bar{x}}{SD(x)/\sqrt{n}}$$

A paired t-test is used to compare two population means where you have two samples in which observations in one sample

can be paired with observations in the other sample. Examples of where this might occur are: - Before-and-after observations on the same subjects (e.g. students' diagnostic test results before and after a particular module or course) or A comparison of two different methods of measurement or two different treatments where the measurements/treatments are applied to the same

One Way ANOVA

The formula for the one-way **ANOVA** *F*-test statistic is

$$F = \frac{\text{between-group variability}}{\text{within-group variability}}.$$

The between-group variability" is

$$\sum_{i=1}^{K} n_i (\bar{Y}_{i\cdot} - \bar{Y})^2 / (K-1)$$

where Y_i denotes the sample mean in the i^{th} group, n_i is the number of observations in the i^{th} group, $\bar{Y}$ denotes the overall mean of the data, and K denotes the number of groups.

The "within-group variability" is

$$\sum_{i=1}^{K} \sum_{j=1}^{n_i} (Y_{ij} - \bar{Y}_{i\cdot})^2 / (N-K),$$

where Y_{ij} is the j^{th} observation in the i^{th} out of K groups and N is the overall sample size.

ANNEXURE – 8

PLAGIARISM REPORT

DrillBit

The Report is Generated by DrillBit Plagiarism Detection Software

Submission Information

Author Name	AKRITI JHA
Title	COMPARATIVE EVALUATION OF THE EFFICACY OF PRF WITH AND WITHOUT LOW-LEVEL LASER THERAPY IN THE TREATMENT OF INTRA-BONY DEFECTS: A CLINICO-RADIOGRAPHIC STUDY
Paper/Submission ID	1407115
Submitted By	amarpal.singh056@bbdu.ac.in
Submission Date	2024-02-07 11:52:18
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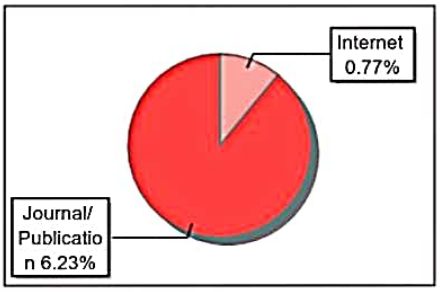

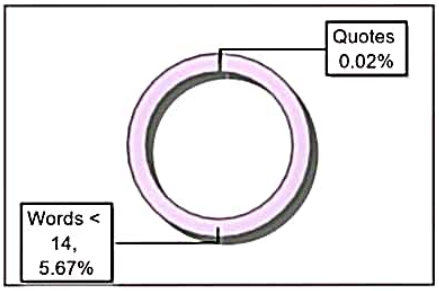

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