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RESEARCH ARTICLE

EFFICACY OF ALB-PRF AS ADJUNCTIVE TO NON-SURGICAL PERIODONTAL THERAPY IN MANAGEMENT OF STAGE II PERIODONTITIS

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Abstract

Objective: This research evaluates the clinical effectiveness of local subgingival delivery of injectable extended platelet-rich fibrin (Alb-PRF) compared withmechanical debridement (MD) alonefor the treatment of stage II periodontitis.
Subject and Methods: Thirty patients diagnosed with stage II periodo ntitis through clinical and radiographic screening were randomly divided into two groups (each group; n=15): group I was treated with MDin combination with Alb-PRF as a local drug delivery (LDD) and group II receivedMD only. Local applications of Alb-PRF during the second visit. Periodontal measurement including plaque index (PI), gingival index (GI), bleeding on probing (BOP), probing depth (PD), and clinical attachment level (CAL) were recorded at baseline, three months and six months after MD.
Results: Clinical outcomes showed Alb-PRF group highly significant improvement in PD reduction and CAL gain measurement compared to group II at three and six months of therapy.
Conclusion: The adjunctive incorporation of Alb PRF with MDsubstan tially improves the outcomes of non-surgical periodontitis treatment, leading to significantly better periodontal health.

Introduction:-

Periodontitis is a complex, multifactorial chronic inflammatory disease initiated by dental plaque biofilm, leading to progressive destruction of the periodontal ligament and alveolar bone.(1) This microbial challenge triggers an exaggerated host immune-inflammatory response.(2) Clinically, periodontitis manifests through bleeding on probing (BOP), gingival inflammation, increased probing depth (PD), clinical attachment loss (CAL), and radiographic alveolar bone resorption.(3) While typically slow, periods of accelerated tissue breakdown can occur.The primary objective of periodontal therapy is to arrest the progression by effectively reducing the microbial burden.(4)

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This is achieved through various therapeutic modalities, with scaling and root planing representing the most widely endorsed non-surgical approach for subgingival biofilm removal.(4, 5) Despite their common use as an adjunct to phase one therapy for targeting residual pathogens, systemic antimicrobial agents exhibit considerable pharmacological obstacles. While systemic antimicrobials play a supportive role in periodontal treatment, their clinical utility is compromised by site-specific inefficacy linked to hepatic transformation and a higher susceptibility to systemic complications.(6, 7)

Moreover, conventional MD has inherent limitations, particularly in accessing deep and the intricate anatomy of tooth surfaces.(8, 9)Consequently, to overcome these limitations and enhance treatment outcomes, the combined application of MD with localized subgingival drug delivery has emerged as a synergistic approach. This strategy aims to improve treatment responses in periodontitis and facilitate periodontal tissue health.(10) While a substantial proportion of individuals diagnosed with periodontitis achieve favorable and enduring therapeutic outcomes through MD alone, many cases exhibit an insufficient response to initial treatment. Furthermore, if surgical interventions are not viable, the strategic integration of adjunctive local therapies becomes crucial.(11)

Therefore, local drug delivery approaches have been proposed to fulfill two primary objectives to afford a mechanism for the protracted and precise delivery of pharmaceutical agents or therapeutic biomolecules, and concurrently, to decrease the dosing regimen, thereby fostering enhanced patient compliance and an improved quality of life.(12, 13)Effective personal oral hygiene is fundamentally dependent upon the prior elimination of pre-existing dental plaque and calculus. Consequently, professional oral prophylaxis and scheduled recall appointments for professional mechanical plaque removal are essential components of comprehensive oral care.(14)

Enhanced periodontal treatment outcomes can also be achieved through the adjunctive use of local drug delivery systems. These modalities—including antimicrobial agents, host-modulating compounds, and autologous platelet concentration — are administered directly into periodontal pockets, providing targeted therapeutic effects that complement conventional scaling and root planing procedures.(15)Hence autologous platelet concentrates (APCs) have emerged as promising biologically active agents in periodontal therapy, offering regenerative and anti-inflammatory properties that enhance both surgical and non-surgical treatment outcomes.(16)

Among the various types of autologous platelet concentrates, platelet-rich fibrin (PRF) stands out for its capacity to stimulate healing. This PRF contains platelets, stem-like cells, cytokines, and growth factors within a structured fibrin network that supports targeted cell migration and differentiation, leading to improved tissue repair.(17-19)

While platelet-rich fibrin (PRF) offers notable regenerative advantages, its clinical efficacy in procedures requiring long-term scaffoldingsuch as guided bone regeneration (GBR)is often limited by its rapid degradation, typically occurring within 2–3 weeks. To overcome this limitation and expand its therapeutic effect, an advanced formulation known as extended platelet rich fibrin (e-PRF) or (Alb-PRF), has been developed. This novel biomaterial involves the thermal denaturation of the liquid portion of autologous plasma, primarily albumin, through a heat-compression process, resulting in the formation of a biocompatible, denser fibrin matrix. This structural enhancement significantly prolongs the functional lifespan of the concentrate and enhances its biological activity, making Alb-PRF a promising scaffold for sustained regenerative applications in periodontal and bone therapies.(20, 21)

Subject and Methods:-

Patients who attended the Department of Oral Medicine and Periodontology at a university dental clinic, were screened for eligibility to participate in the study. The study protocol was approved by the institutional ethics committee(Ref: A0401024OM) and registered on ClinicalTrials.gov (ID: NCT07080294).

Initially, the study included 30 patients diagnosed clinically and radiographically with stage II periodontitis according to the 2017 World Workshop classification.(22)Patients were randomly allocated into two equal groups (n=15 each): group I (Test group): MD with Alb-PRF injection, while group II (control group): MD only. All eligible participants underwent intraoral radiographic evaluations at baseline,three months and six months. The radiographs were assessed to evaluate the interdental alveolar bone levels at the sites corresponding to the periodontal pockets.

1.1 Exclusion criteria

(a) Periodontitis patients with stage I, III, IV.
(b) pregnant or lactating women.
(c) Systemic disease which could influence the outcome oftherapy.
(d) Smoking.
(e) Patients with a history of periodontal treatment or oral infections for at least three months.

1.2 Inclusion criteria

(a) Patients with stage II (pocket less than 5 mm and CAL 3-4 mm).
(b) Systemically healthy individuals are aged between 30 and 50 years.
(c) Good compliance of plaque control instructions following phase I therapy.
(d) Access to follow-up care and maintenance program.

Sample Size Calculation:

Sample size estimation was performed using power analysis via G*Power software version 3.1.9.7, referencing a similar clinical trial design.(23)To achieve a statistical power of 90% (1-β = 0.90) with a significant level of 0.05 and an effect size of 0.25, a total of 30 samples was required. Accordingly, 30 defects were included and equally allocated into two groups (n=15 per group), providing sufficient power to detect statistically significant differences in clinical parameters between the studied groups over the follow-up periods.

Randomization, blinding, and allocation:

Participants were allocated to either the test or control group through a process of random assignment. This was achieved using a computer-generated randomization sequence obtained from an external web-based tool (e.g., www.randomizer.org). Crucially, the allocation sequence was concealed from the researchers and participants until the moment of intervention assignment, thereby ensuring allocation concealment and minimizing selection bias. Participants were equally prepared for all three clinical procedures, then were allocated to either tests or control groups.

Preoperative Phase Participants who fulfilled all inclusion criteria underwent intraoral radiographic examinations and received comprehensive full-mouth phase I periodontal therapy. Treatment was performed under local anesthesia, when it was necessary, and was completed in two visits within a 15-day period. The therapy included both ultrasonic and manual instrumentation, with supragingival mechanical debridement performed using a piezoelectric ultrasonic scaler (Woodpecker Medical Instrument Co., Guilin, China).

Following initial therapy, participants were provided with standardized oral hygiene instructions. These included training in the modified Bass tooth brushing technique using a soft-bristled toothbrush and regular toothpaste twice daily. Interdental cleaning was also emphasized, and patients were instructed to perform it daily using dental floss or interdental brushes.

Gel Administration: A total of 10 ml of whole blood was collected from each participant using sterile plastic tubes

(Vacutest Kima, Arzergrande, Italy) and centrifuged at 700 g for 8 minutes in horizontal centrifuge (DLAPDM2424, China). Following centrifugation, the upper yellow plasma layer was identified as the liquid plasma component. The uppermost portion of this layer, corresponding to platelet-poor plasma (PPP), was aspirated into a sterile syringe. PPP was heated at 75°C for 10 minutes to denature plasma proteins then cooled for approximately 2 minutes then mixed with the intermediate plasma fraction containing the buffy coat, rich in platelets and leukocytes (liquid-PRF),using a sterile female–female luer lock connector to obtain a homogenized injectable e-PRF, which was immediately applied at the treatment site in group I.(20)Injection was administered using a 3 ml syringe with a blunt tip into the deepest periodontal pocket after two weeks of MD. Patients were instructed to avoid brushing or flossing at the treated sites for the first 48 hours to permit gel stabilization and retention. Gentle brushing away from treated areas is acceptable.

Clinical Periodontal Assessment

Periodontal evaluation ofPI, GI, BOP, PD and CAL at baseline, three months, and six months of therapy.(24-29)

Statistical analysis

All statistical procedures were conducted using IBM SPSS Statistics, version 27.0 (IBM Corp., Armonk, NY, 2020).Categorical variables are reported as frequencies (n) and corresponding percentages (%). Inter-group comparisons for categorical data were performed using the Chi-square test. When the assumption for the Chi-square test was not met (specifically, if more than 20% of the cells had an expected count less than 5), the Fisher's exact test was applied.Quantitative data were summarized using the mean and standard deviation (SD).

The normality of continuous variables was assessed using the Shapiro–Wilk test for sample sizes of 50 or fewer. For normally distributed quantitative variables, the Student's t-test was employed to compare the two study groups. Comparisons involving more than two time points or periods were analyzed using Analysis of Variance (ANOVA) with repeated measures.Statistical significance for all tests was determined at a two-sided p-value < 0.05.

Results:-

The study included thirty participants randomized into two groups: MD + e-PRF group (group I, n=15) and MD alone group (group II, n=15). In the MD + e-PRF group, 4 participants (26.7%) were male and 11 (73.3%) were female, while the MD group consisted of 5 males (33.3%) and 10 females (66.7%). The mean age was 39.20 ± 5.80 years for group I and 41.87 ± 8.04 years for group II.

Statistical analysis of these demographic data in Table (1) indicates no significant differences between the two groups in terms of sex distribution (p = 1.000) or mean age (p = 0.306). These findings confirm that both groups were comparable in their baseline characteristics, ensuring a well-balanced foundation for the clinical evaluation of the two treatment modalities.The clinical parameters for both group I and group II were evaluated at baseline, three months and six months, with a comparative analysis presented in Table (2).

Initially, no significant differences were observed between the groups for any of the measured parameters. At baseline, the mean PI scores were comparable between group I (2.13 ± 0.47) and group II (2.09 ± 0.35) (P = 0.823). Similarly, the mean GI scores (1.97 ± 0.48 vs. 1.98 ± 0.32; P = 0.965), BOP values (0.85 ± 0.26 vs. 0.83 ± 0.15; P = 0.825), PD measurements (3.77 ± 0.33 mm vs. 3.81 ± 0.28 mm; P = 0.681), and CAL (4.30 ± 0.37 mm vs. 4.55 ± 0.38 mm; P = 0.073) were all statistically similar between the two groups.

At three monthfollow-up, significant differences began to emerge for most parameters. While PI values remained similar (1.69 ± 0.51 vs. 1.69 ± 0.35; P = 0.993) and no significant difference was found for BOP (0.67 ± 0.20 vs. 0.76 ± 0.17; P = 0.188), group I demonstrated significantly better outcomes for other metrics. Group II showed a lower mean of GI (1.47 ± 0.40) than group II (1.75 ± 0.28) (P = 0.035), a significant reduction in PD (3.37 ± 0.23 mm vs. 3.73 ± 0.31 mm; P = 0.001), and a significant gain in CAL (3.95 ± 0.29 mm vs. 4.47 ± 0.42 mm; P < 0.001).

atsix month, group I exhibited superior results across all clinical parameters. Group I showed a significantly lower mean PI (0.96 ± 0.25 vs. 1.47 ± 0.46; P = 0.001), GI (0.80 ± 0.26 vs. 1.07 ± 0.26; P = 0.008), and BOP (0.38 ± 0.11 vs. 0.67 ± 0.12; P < 0.001) compared to group II. Furthermore, the significant improvements in PD (3.0 ± 0.19 mm vs. 3.70 ± 0.36 mm; P < 0.001) and CAL (3.81 ± 0.25 mm vs. 4.44 ± 0.45 mm; P < 0.001) were maintained and enhanced.

Over the entire six month study period, intragroup analysis confirmed that both treatment protocols resulted in statistically significant improvements from baseline for all parameters. For group I, the reduction was highly significant ($P_o < 0.001$) for all five metrics. For group II, significant reductions were also noted for PI ($P_o < 0.001$), GI ($P_o < 0.001$), BOP ($P_o = 0.006$), PD ($P_o = 0.019$), and CAL ($P_o = 0.019$).

Discussion :-

The primary objective of the study was to assess the clinical efficacy of Alb-PRF as an adjunct to MD in the management of stage II periodontitis. It is important to note that since Alb-PRF is a relatively recent innovation in the field of regenerative dentistry, the clinical comparisons in this discussion involve various generations of platelet concentrates. These include traditional PRF, L-PRF andi-PRF, all of which share the foundational biological principle of using concentrated autologous growth factors to enhance periodontal healing, similar to the Alb-PRF used in this study.

Regarding the PI, Alb-PRF group showed a significant decrease from 2.13 ± 0.47 at baseline to 0.96 ± 0.25 at six months. Parallel to this, the GI demonstrated a superior reduction from 1.97 ± 0.48 to 0.80 ± 0.26 during the same period. These results were statistically superior to the control group, which recorded higher mean scores for both PI (1.47 ± 0.46) and GI (1.07 ± 0.26) at the end of the study ($p < 0.05$). This synchronized improvement suggests that the enhanced gingival consistency and the reduction PD provided by Alb-PRF facilitated better plaque control and reduced the niche for microbial colonization.

Our findings align with the trends reported by Youssef et al. (2024)(30) regarding the benefits of platelet concentrates in soft tissue healing. However, this study offers a distinct advantage over Alghannam et al. (2024)(31), who observed an increase in PI and GI scores between the 3rd and 6th months. The sustained stability in the results is attributed to the thermal denaturation of albumin, which creates a long-lasting biological scaffold that persists for 4–6 weeks, providing a slow-release mechanism for growth factors that maintains a healthy, inflammation-free environment far longer than conventional i-PRF.

PD reduction was a pivotal finding, with the Alb-PRF group improving from 4.33 ± 0.49 mm to 2.53 ± 0.52 mm at six months, significantly outperforming the control group (3.33 ± 0.49 mm; $p < 0.001$). These results are consistent with Parwani et al. (2024)(32), who used PRF derivatives to enhance MD. The physical presence of Alb-PRF as a biological plug provides a mechanical advantage, preventing the early collapse of the pocket wall and allowing for more stable healing of the periodontal tissues.

The Alb-PRF group exhibited a highly significant gain in CAL, improving from 4.33 ± 0.49 mm at baseline to 2.53 ± 0.52 mm at six months. This outcome supports the regenerative potential of Alb-PRF. The thermal processing of albumin creates a three-dimensional scaffold that provides superior space-maintenance. This protects the blood clot and provides a protected niche for the proliferation of periodontal ligament cells, explaining the absence of the "rebound effect" often noted in studies using short-acting concentrates(i-PRF) like those investigated by Alghannam et al. (2024).(31)

BOPresolution of inflammation was further confirmed by the significant reductionin BOP. In the Alb-PRF group, the mean BOP score dropped from 0.85 ± 0.26 at baseline to 0.67 ± 0.20 at three months, eventually reaching a low of 0.38 ± 0.11 at six months. In contrast, the control group showed significantly higher bleeding scores (0.67 ± 0.12) at the end of the study ($p < 0.001$). These results are in harmony with Gürbüz and Yıldıran (2025)(33), suggesting that the concentrated growth factors in the Alb-PRF matrix accelerate vascular maturation and reduce tissue fragility more effectively than mechanical therapy alone, even in challenging periodontal environments.

Conclusion:-
Alb-PRF as an adjunct to MD provides a more stable and clinically superior outcome compared to MD alone or conventional, short-acting platelet derivatives.

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Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethical approval

The study was approved by the Ethics Committee (Code: A0401024OM).

conflict of interest

The authors affirm that there are no conflicts of interest to disclose regarding the publication of this paper.

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