IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 22, Issue 4 Ser.10 (April. 2023), PP 08-14
www.iosrjournals.org

Immediate Implant Placement Followed By Sticky Bone and PRF Membrane Placement to Achieve Osseous Regeneration: A Case Report

Chacko Lisa[1], Kamble Abhishek V[2], DalveDeveshri R[3], Rakhewar P.S.[4], PatilSaurabh S[5]

[1]Professor, [2]PG student, [3] PG student, [4]H.O.D and Professor, [5]Reader,
Department of Periodontology and Oral Implantology, S.M.B.T. Dental College and Hospital, Sangamner – 422608, Ahmednagar, Maharashtra, India

Abstract:
This case report describes extraction of root pieces of maxillary left first and second molars, followed by placement of immediate implants in the prepared sockets, sticky bone and PRF membrane placement for bone regeneration and final prosthetic restoration over the implants after 6 months.

Materials and methods: *The root pieces were extracted with minimal trauma to adjacent hard and soft tissue architecture. The sockets were prepared according to the requires dimensions and the implants were inserted. Sticky bone PRF membrane were placed to gain osseous regeneration.6 months post-operative, an impression was made and a definitive restoration was placed.*

Results: *The conducted treatment resulted in formation of bone around the implants as well as preservation of the existing hard and soft tissues. The patient reported no clinical or radiological complications throughout the course of the treatment.*

Conclusion: *The use of sticky bone and PRF membrane during placing an immediate implant, aids in its stable placement through hard tissue regeneration.*

Key words: *Dental implant, sticky bone, PRF, regeneration.*

Date of Submission: 10-04-2023 Date of Acceptance: 23-04-2023

I. INTRODUCTION

Endosseous dental implant therapy has been rapidly becoming the prosthetic treatment of choice for a wide range of clinical applications to restore a missing natural tooth. Dental implants have been shown to successfully replace missing teeth while providing all restorative functional needs. They have steadily progressed to become an important modality of restoring incomplete dentitions in either fully or partially edentulous patients. (1) Osseo-integrated dental implants have shown relatively high rates of success in both the maxillary and the mandibular jaws. The American Academy of Implant Dentistry (AAID), the American Dental Association (ADA), and various professional organizations have advocated the placement of osseo-integrated dental implants as a viable and predictable treatment modality. (2)

An extraction socket, during its healing phase often tends to produce bone resorption, which might lead to the site for implant placement getting compromised.(3)Placement of an implant immediately after tooth extraction may be beneficial to maintain the bone crest and can facilitate ideal implant positioning from a prosthetic point of view.(4, 5)Various authors have advocated the use of immediate implants.(6-11) The therapeutical advantages of immediate implant placement are – morbidity reduction, shorter treatment time required, preservation of residual ridge width and height, desired esthetic outcomes, guidance of implant placementthrough the bone socket, better tendency for osseointegration due to the healing potential of the fresh extraction site.(5, 12-15) These advantagesoften present along with one disadvantage which is failure of adaptation of the alveolar bone, particularly in the cervical aspect of theimplant.(14, 16, 17) This area is identical to a circumferential vertical defect and can give shelter to soft tissues.(14, 18, 19) Replacing an extracted tooth with an implant immediately, often involves utilizing osseous regeneration techniques. A very small number of peri-implant defects do not require barrier membranes or bone grafts to be used.In these cases, either the sockets are intact, a favorable defectmorphology is present, or an implant with anappropriate surface is used.(12,18,19)However, circumferentialdefects at the coronal aspect of extraction sockets contained with osteopromotive agentshave the tendency to get filled with blood and bone. (20)

The phenomenon of bone regeneration along with the removal of all the extra-skeletal non-osteogenic cells from an osseous defect is widely established in implant dentistry.[21]Several animal and clinical trials have demonstrated the efficacy of using regenerative procedures around immediately placed dental implants using a variety of materials. [6, 21-28]These publications have reported the stability ofthe regenerated hard tissues over time and their ability to provide support and aid in functioning ofosseo-integrated implants. Hard tissue reconstruction is facilitated by guided bone regeneration through prevention of epithelial cell migration in the defect area. The rate of osteogenesis extending inward from the adjacent bony margins should be greater than the rate of fibrogenesis growing in from the surrounding soft tissue.[29]

Platelet concentrates are widely used for surgicalprocedures in various medical fields. The objective of these technologies is to extract (through centrifugation)all the elements from a blood sample that could be usefulto additionally benefit healing as well as promote tissue regeneration.[30]Dohan*et al*., first developed PRF for use in oral and maxillofacial surgery.Platelets are trapped in the fibrin meshes and the successof this technique is completely dependent on the speed of bloodcollection and its transfer to the centrifuge.[31]Injectable PRF (i-PRF) is a platelet concentrate in the liquid form which can be polymerized with bone graft. Since,i-PRF is autogenous, there is reduction in the chances of adverse reactionto the implanted materials, especially immune mediatedones as with other type of grafts, which qualify it as asuitable option in bone regeneration. The combination of i-PRF and bone graft is known as "sticky bone." It forms a well-agglutinated "steak for bone grafting" byallowing theincorporation of graft without the use of anticoagulantsor additives. [32] Sticky bone also provides stabilization of bone graft in the defect, and therefore, accelerates tissue healing and minimizes bone loss during the healing period. [33]

In this case report, atraumatic extraction of root pieces followed by immediate implant placement was carried out in the maxillary left first and second molar regions. Sticky bone and PRF membrane placement were done to promote hard tissueregeneration around the implants. The bone graft used wasOsseograft® - DMBM (Demineralized Bone Matrix).

II. CASE REPORT

A 30-year-old female patient reported with complete loss of crown structure of the maxillary left first and second molars. On obtaining history from the patient, it was found that these teeth undergone loss of crown structure due to caries. Medical history of the patient was non-contributory.Diagnostic impressions were made. Radiographic examination was done using orthopantomography and it revealed presenceof adequate amount of alveolar bone for placement of endosseous implants. Thus, it was decided to extract the remaining root pieces and place the implants immediately.

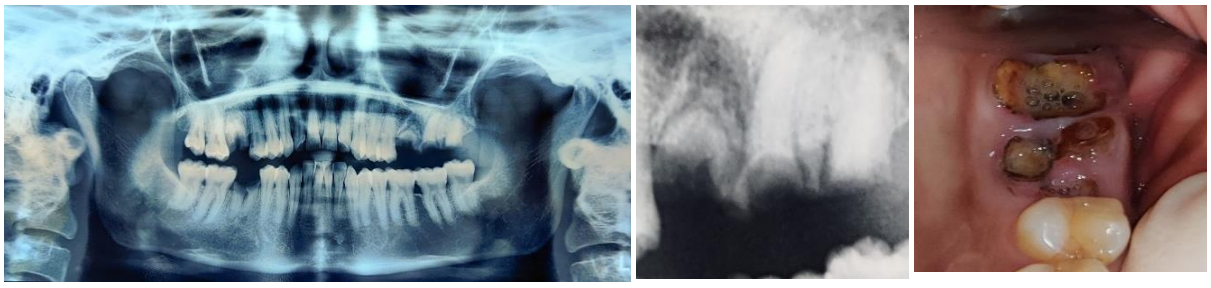

Fig. 1 Pre-operative radiographs and clinical view

The surgical procedure was performed in sterile surgical field. Local anesthesia was given using 2% lidocaine with 1:80000 adrenaline. Atraumatic extraction of the root pieces was carried out in order to preserve the buccal and palatal bone walls, using periotomes, elevators and maxillary root forceps.Crestal incision was placed and full thickness mucoperiosteal flaps were raised buccally as well as palatally. The remaining soft tissues were removed from and around the extraction sockets using curettes.

Fig. 2 Post-extraction

Bone sockets of the first molar and second molar were prepared through sequential drilling for the placement of ADIN's 3.75 x 8 mm and 4.2 x 10 mm implants respectively. The implants were placed and primary stability was achieved, followed by placement of cover screws.

Fig. 3Osteotomy preparation

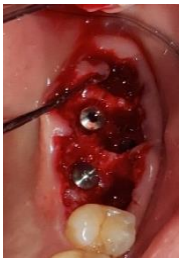

Fig. 4Implant placement

10 ml of venous blood was withdrawn under aseptic conditionsby venipuncture of the antecubital vein and transferredintosterile tubes which were devoid of anticoagulants. i‑ PRF preparation was done using the protocol developed by Mourãoet al. [32]The settings used for centrifugation were at 700 rpm for 3 minutes. An orange‑ colored fluid was formed as the upper layer in the test tubes i.e., i‑ PRF. Approximately 1 ml of i-PRF was collected in a syringe.Osseograft® particles were dispensed in a sterile bone well, and i‑ PRF was added to the bone graft particles. The process of polymerization underwent and by 15-20 minutes sticky bone was ready to be grafted.

PRF was prepared according to the protocol adopted in a study conducted by Pradeep et al. [34] Blood was centrifuged at a speed of 3000 rpm for 10 minutes to obtain autologous PRF layer between a base of red blood cells (RBCs) at the bottom and acellular plasma on the surface. Separation of surface acellular plasma was carried out by pipetting 2–3 ml of the top layer and the RBC layer was removed/cut and the PRF was placed in a sterile dappen dish. Eventually, the PRF plug was converted into a PRF membrane by keeping it in between two wet gauze pieces and applying slight pressure on it.

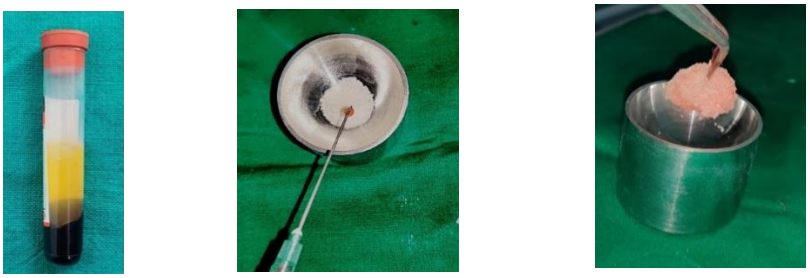

Fig. 5PRF and sticky bone preparation

The sticky bone graft was condensed and adapted into the peri-implant defects, remaining sockets as well as over the implants. Further, it was covered with PRF membrane. The surgical site was closed using interrupted sutures. Post-operative radiograph was taken and it showed suitable placement of the implants. Periodontal dressing was applied. Oral hygiene and post-operative instructions were explained to the patient.A 3-day regime ofamoxicillin 500 mg (TID), diclofenac + paracetamol + seratiopeptidase (BD), and pantoprazole 40 mg (BD) was prescribed. Periodontal dressing and suture removal was done after 10 days.

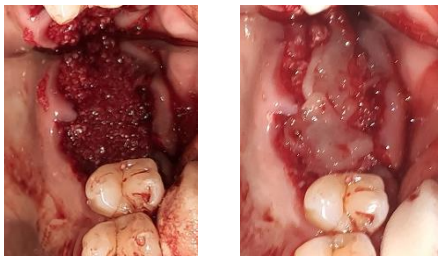

Fig. 6Sticky bone and PRF membrane placement

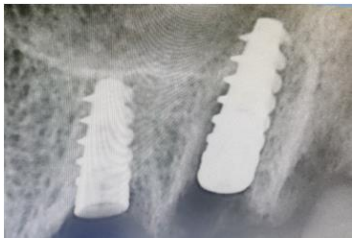

Fig. 7Post-operative radiograph

After 6 months, the site was re-entered and healing abutments were placed on both the implants. A considerably good amount of bone regeneration was observed around the implants. On radiographic examination, intraoral periapical radiographs also revealed evidence of hard tissue formation. Later, after 15 days of placement of healing abutments, suture removal was done and impressions were made using the closed tray impression copings in order to fabricate a 2-unit PFM prosthesis. Two straight titanium prosthetic abutments of 2 mm were selected.The final restoration was cemented after 10 days.

Fig. 8Healing abutments

Fig. 9Gingival collar

Fig. 10Prosthetic abutments

Fig. 11PFM prosthesis placement

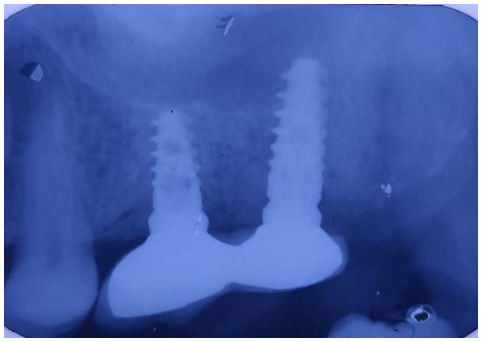

Fig. 11Radiograph post prosthesis placement

III. DISCUSSION

Over the years, it has been noted that non-submerged implants do not compromise hard and/or soft tissue integration or the long-term results of implant treatment.[35-37] Studies conducted regarding also reported that there is bone fill in peri-implant defects as well as close contact between newly regenerated bone and implant surfaces.[38-40]When conducting osseous regenerative procedures for implants, it is essential to form a space that is properly isolated from the adjacent soft tissues and can be maintained as well for an appropriate period to ensure osteogenesis. The PRF membrane, in addition to space maintenance, also plays a role in clot stabilization while simultaneously preventing migration of non-osteogenic tissues into the area. Although, PRF membrane along with a collagen membrane could be a better alternative for the same. [41] Resorbable as well as non-resorbable membranes have been used for bone regeneration techniques in fresh sockets. Although, with utilizing non-resorbable membranes, there is a greater risk of membrane exposure during healing, accompanied by bacterial colonization of the membrane and therefore a reduced level of bone regeneration. [10]

Platelet-rich fibrin (PRF) was developed as an autologous platelet concentrate without the use of anticoagulants, first introduced by Choukroun et al. (2001). [42] It has been reported that PRF acts by releasing growth factors via the use of a fibrin scaffold capable of entrapping growth factors and releasing them slowly over time, as well as additionally providing a housing for leukocytes, which is responsible for additional growth factor release.[43]

It has also been demonstrated that by decreasing centrifugation speeds, the upper layer tends to maintain a larger proportion of leukocytes where PRF is collected and thus further increasing total growth factor release. A new phenomenon of a liquid injectable-platelet-rich fibrin (i-PRF) was developed in 2014, by modifying spin centrifugation forces. The rate of fibrin coagulation can be slowed down by utilizing lower centrifugation speeds and non-glass test tubes thereby generating an injectable-PRF. Similarly, like traditional PRF, i-PRF consists of an increased leukocyte count and is further able to generate growth factor release.[44]i-PRF also possesses the property of bonding with the graft materials and thus facilitating the proper adaptation of the graft into the defect sites.[32]

Demineralized bone matrix (DMBM) is a bone inductive sterile bioresorbablexenograft which is prepared from bovine cortical bone samples. It results in formation of non-immunogenic flowable particles ofapproximately 250 μm that are completely replaced byhost bone in 4–24 weeks. Studieshave reported thatlow-molecular-weight, acid-insoluble proteins containedin small quantities in the matrix may act as modulatorsof the bone induction process. These proteins are knownas bone morphogenetic proteins (BMPs).[45, 46, 47]Osseograft®, is a type I collagen derived bone graft (xenograft). It is osteoinductive as well as osteoconductive, and easily resorbable. It also has the tendency to inhibit non-osteogenic cells.

In this case report, the use of sticky bone and PRF membrane provided acceptable results for bone formation around implants. The additional benefit of the platelet concentrates along with the DMBM bone graft was well observed in this case.

IV. CONCLUSION

Osseous regeneration with bone deficient areas is a suitable therapeutic modality for simultaneous implant placement carried out after tooth extraction. Since its development, PRF has been showing promising results in bone formation via the release of growth factors. Also, polymerization of bone graft substitute with injectable-PRF also aids in the stabilization of grafts in the defect areas. Platelet-rich fibrin can be considered as an option to be routinely usedas they are autologous and can be easily prepared.

REFERENCES:

[1]. Tsao YP, Wang HL. Periodontal considerations in implant therapy. Int Chin J Dent. 2003;3:13-30.
[2]. Silverstein LH, Melkonian R. Periodontal considerations of dental implantology. Clark's Dentistry. 1998:1-5.
[3]. Kohal RJ, Mellas P, Hürzeler MB, Trejo PM, Morrison E, Caffesse RG. The effects of guided bone regeneration and grafting on implants placed into immediate extraction sockets. An experimental study in dogs. Journal of Periodontology. 1998 Aug;69(8):927-37.
[4]. Shanaman RH. The use of guided tissue regeneration to facilitate ideal prosthetic placement of implants. International Journal of Periodontics & Restorative Dentistry. 1992 Aug 1;12(4).
[5]. Watzek G, Haider R, Mensdorff-Pouilly N, Haas R. Immediate and delayed implantation for complete restoration of the jaw following extraction of all residual teeth: a retrospective study comparing different types of serial immediate implantation. International Journal of Oral & Maxillofacial Implants. 1995 Sep 1;10(5).
[6]. Becker W, Becker BE, Handelsman M, Ochsenbein C, Albrektsson T. Guided tissue regeneration for implants placed into extraction sockets: A study in dogs. Journal of Periodontology. 1991 Nov;62(11):703-9.
[7]. Krump JL, Barnett BG. The immediate implant: a treatment alternative. International Journal of Oral & Maxillofacial Implants. 1991 Mar 1;6(1).
[8]. Lazzara RJ. Immediate implant placement into extraction sites: surgical and restorative advantages. Int. J. Periodont. Rest. Dent..1989;9:332-43.
[9]. Tolman DE, Keller EE. Endosseous Implant Placement Immediately Following Dental Extraction and Alveoloplasty: Preliminary Report With 6-Year Follow-up. International Journal of Oral & Maxillofacial Implants. 1991 Mar 1;6(1).
[10]. Becker W, Dahlin C, Becker BE, Lekholm U, van Steenberghe D, Higuchi K, Kultje C. The use of e-PTFE barrier membranes for bone promotion around titanium implants placed into extraction sockets: a prospective multicenter study. International Journal of Oral & Maxillofacial Implants. 1994 Jan 1;9(1).
[11]. Henry PJ, Tan AE, Leavy J, Johansson CB, Albrektsson T. Tissue regeneration in bony defects adjacent to immediately loaded titanium implants placed into extraction sockets: a study in dogs. International Journal of Oral & Maxillofacial Implants. 1997 Nov 1;12(6).
[12]. Wilson Jr TG, Schenk R, Buser D, Cochran D. Implants placed in immediate extraction sites: a report of histologic and histometric analyses of human biopsies. International Journal of Oral & Maxillofacial Implants. 1998 May 1;13(3).
[13]. Becker W, Clokie C, Sennerby L, Urist MR, Becker BE. Histologic findings after implantation and evaluation of different grafting materials and titanium micro screws into extraction sockets. Journal of periodontology. 1998 Apr;69(4):414-21.
[14]. Brunel G, Benqué E, Elharar F, Sansac C, Duffort JF, Barthet P, Baysse E, Miller N. Guided bone regeneration for immediate non- submerged implant placement using bioabsorbable materials in Beagle dogs. Clinical oral implants research. 1998 Oct;9(5):303-12.
[15]. Grunder U, Polizzi G, Goené R, Hatano N, Henry P, Jackson WJ, Kawamura K, Köhler S, Renouard F, Rosenberg R, Triplett G. A 3-year prospective multicenter follow-up report on the immediate and delayed-immediate placement of implants. International Journal of Oral & Maxillofacial Implants. 1999 Mar 1;14(2).
[16]. Zitzmann NU, Naef R, Schupbach P, Schaerer P. Immediate or delayed immediate implantation versus late implantation when using the principles of guided bone regeneration. Acta Med Dent Helv. 1996;1:221-7.
[17]. Cornelini R, Scarano A, Covani U, Petrone G, Piattelli A. Immediate one-stage postextraction implant: a human clinical and histologic case report. International Journal of Oral & Maxillofacial Implants. 2000 May 1;15(3).
[18]. Knox R, Caudill R, Meffert R. Histologic evaluation of dental endosseous implants placed in surgically created extraction defects. The International journal of periodontics & restorative dentistry. 1991;11(5):364-75.
[19]. Carlsson L, Röstlund T, Albrektsson B, Albrektsson T. Implant fixation improved by close fit cylindrical implant–bone interface studied in rabbits. Acta Orthopaedica Scandinavica. 1988 Jan 1;59(3):272-5.
[20]. Becker BE, Becker W, Ricci A, Geurs N. A prospective clinical trial of endosseous screw- shaped implants placed at the time of tooth extraction without augmentation. Journal of Periodontology. 1998 Aug;69(8):920-6.
[21]. Fugazzatto PA. Immediate implant placement and GBR in humans: a case report and histologic evaluation. International Journal of Periodontics & Restorative Dentistry. 1999 Oct 1;19(5).
[22]. Dahlin C, Sennerby L, Lekholm U, Linde A, Nyman S. Generation of new bone around titanium implants using a membrane technique: an experimental study in rabbits. International Journal of Oral & Maxillofacial Implants. 1989 Mar 1;4(1).
[23]. Jovanovic SA, Spiekermann H, Richter EJ. Bone regeneration around titanium dental implants in dehisced defect sites: a clinical study. International Journal of Oral & Maxillofacial Implants. 1992 Jun 1;7(2).
[24]. Mellonig JT, Triplett R. Guided tissue regeneration and endosseous dental implants. International Journal of Periodontics & Restorative Dentistry. 1993 Apr 1;13(2).
[25]. Fugazzotto PA, Shanaman R, Manos T, Shectman R. Guided bone regeneration around titanium implants: report of the treatment of 1,503 sites with clinical reentries. International Journal of Periodontics & Restorative Dentistry. 1997 Jun 1;17(3).
[26]. Fugazzatto PA. Immediate implant placement and GBR in humans: a case report and histologic evaluation. International Journal of Periodontics & Restorative Dentistry. 1999 Oct 1;19(5).
[27]. Shanaman RH. A retrospective study of 237 sites treated consecutively with guided tissue regeneration. International Journal of Periodontics & Restorative Dentistry. 1994 Aug 1;14(4).
[28]. Fugazzotto PA. Success and failure rates of osseointegrated implants in function in regenerated bone for 6 to 51 months: a preliminary report. International Journal of Oral & Maxillofacial Implants. 1997 Jan 1;12(1).
[29]. Gher ME, Quintero G, Assad D, Monaco E, Richardson AC. Bone grafting and guided bone regeneration for immediate dental implants in humans. Journal of periodontology. 1994 Sep;65(9):881-91.
[30]. Agrawal AA. Evolution, current status and advances in application of platelet concentrate in periodontics and implantology. World journal of clinical cases. 2017 May 5;5(5):159.
[31]. Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJ, Mouhyi J, Gogly B. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part I: technological concepts and evolution. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2006 Mar 1;101(3):e37-44.
[32]. Mourão CF, Valiense H, Melo ER, Mourão NB, Maia MD. Obtention of injectable platelets rich-fibrin (i-PRF) and its polymerization with bone graft. Revista do ColégioBrasileiro de Cirurgiões. 2015 Nov;42:421-3.
[33]. Sohn DS, Huang B, Kim J, Park WE, Park CC. Utilization of autologous concentrated growth factors (CGF) enriched bone graft matrix (Sticky bone) and CGF-enriched fibrin membrane in Implant Dentistry. J Implant Adv Clin Dent. 2015 Dec;7(10):11-8.

[34]. Pradeep AR, Rao NS, Agarwal E, Bajaj P, Kumari M, Naik SB. Comparative evaluation of autologous platelet- rich fibrin and platelet- rich plasma in the treatment of 3- wall intrabony defects in chronic periodontitis: A randomized controlled clinical trial. Journal of periodontology. 2012 Dec;83(12):1499-507.
[35]. Ericsson I, Nilner K, Klinge B, Glantz PO. Radiographical and histological characteristics of ssubmerged and nonsubmerged titanium implants. An experimental study in the Labrador dog. Clinical Oral Implants Research. 1996 Mar;7(1):20-6.
[36]. Gotfredsen K, Rostrup E, Hjörting- hansen E, Stoltze K, Budtz- jörgensen E. Histological and histomorphometrical evaluation of tissue reactions adjacent to endosteal implants in monkey's. Clinical oral implants research. 1991 Jan;2(1):30-7.
[37]. Weber HP, Buser D, Donath K, Fiorellini JP, Doppalapudi V, Paquette DW, Williams RC. Comparison of healed tissues adjacent to submerged and non- submerged unloaded titanium dental implants. A histometric study in beagle dogs. Clinical Oral Implants Research. 1996 Mar;7(1):11-9.
[38]. Becker W, Schenk R, Higuchi K, Lekholm U, Becker BE. Variations in bone regeneration adjacent to implants augmented with barrier membranes alone or with demineralized freeze-dried bone or autologous grafts: a study in dogs. International Journal of Oral & Maxillofacial Implants. 1995 Mar 1;10(2).
[39]. Buser D, Ruskin J, Higginbottom F, Hardwick R, Dahlin C, Schenk RK. Osseointegration of Titanium Implants in Bone Regenerated in Membrane-Protected Defects: A Histologic Study in the Canine Mandible. International Journal of Oral & Maxillofacial Implants. 1995 Nov 1;10(6).
[40]. Warrer K, Gotfredsen K, Hjsrting- hansen E, Karring T. Guided tissue regeneration ensures osseointegration of dental implants placed into extraction sockets. An experimental study in monkeys. Clinical Oral Implants Research. 1991 Oct;2(4):166-71.
[41]. Aprajita B. Guided bone regeneration using a platelet-rich fibrin membrane and sticky bone graft along with implant placement in maxillary anterior region: a case report. J Adv Med Dental Sci Res. 2018 May;6(5):2.
[42]. Choukroun J, Adda F, Schoeffler C, Vervelle AP. Une opportunitéenparo-implantologie: le PRF. Implantodontie. 2001 Jan;42(55):e62.
[43]. Barrick B, Campbell EJ, Owen CA. Leukocyte proteinases in wound healing: roles in physiologic and pathologic processes. Wound Repair and Regeneration. 1999 Nov;7(6):410-22.
[44]. Ghanaati S, Booms P, Orlowska A, Kubesch A, Lorenz J, Rutkowski J, Landes C, Sader R, Kirkpatrick CJ, Choukroun J. Advanced platelet-rich fibrin: a new concept for cell-based tissue engineering by means of inflammatory cells. Journal of Oral Implantology. 2014 Dec;40(6):679-89.
[45]. Urist MR, Lietze A, Mizutani H, Takagi K, Triffitt JT, Amstutz J, Delange R, Termine J Finerman GA. A bovine low molecular weight bone morphogenetic protein (BMP) fraction. Clinical Orthopaedics and Related Research (1976-2007). 1982 Jan 1;162:219-32.
[46]. Lee MB. Bone morphogenetic proteins: background and implications for oral reconstruction: a review. Journal of clinical periodontology. 1997 Jun;24(6):355-65.
[47]. Balakrishnan S, Seshan H. Management of intrabony defect with Osseograft and with membrane. Kerala Dental Journal.:217.

Chacko Lisa, et. al.″ Immediate Implant Placement Followed By Sticky Bone And PRF Membrane Placement To Achieve Osseous Regeneration: A Case Report.*″ IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) 22(4),* 2023, pp. 08-14.