Use of Platelet Rich Fibrin (PRF) for the prevention of localized osteitis in lower third molar sites

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Objective. Platelet Rich Fibrin (PRF) has been reported to aid in wound healing of extraction sites and in this case study, PRF was utilized to prevent the formation of localized osteitis.

Methods. Platelet Rich Fibrin was placed bilaterally within lower third molar extraction sites, 168 sites total, on 84 consecutive patients who underwent indicated third molar removal surgery. The patients were managed with standard surgical techniques, intra-operative IV antibiotic/steroid coverage, routine post-operative narcotic analgesics/short-term steroid coverage. All patients were re-evaluated for localized osteitis within 10 days of the surgery. A control group consisted of 84 consecutive patients who underwent removal of indicated lower wisdom teeth and did not receive PRF placement within the surgical sites.

Results. The incidence of localized osteitis following removal of 168 lower third molars with simultaneous PRF placement within the extraction site was zero. The control group had an 8\% incidence of localized osteitis.

Conclusions. This study demonstrated that preventative treatment of localized osteitis can be accomplished using a low cost autogenous soluble biologic material (PRF) and that PRF provided localized enhanced healing socket healing/clot retention regardless of patient demographics.

Localized Osteitis (“Dry Sockets”) may occur in all locations where teeth are removed but the majority of localized osteitis incidence is within mandibular molar region (45\% for the third molars) and prevention of LO has been difficult to achieve ever since the first tooth was ever removed.\textsuperscript{1} We chose the bilateral lower third molar region to demonstrate the effectiveness of Platelet Rich Fibrin (PRF) in prevention of LO and clinically based the occurrence of LO on regional discomfort and the partial or complete loss of the clot within the third molar site. Localized osteitis is also called, alveolar osteitis, alveolitis sicca dolorosa, septic socket, necrotic socket, localized osteomyelitis, and fibrinolytic alveolitis among other terms to describe this phenomenon.\textsuperscript{2}

Localized Osteitis is characterized as post-operative pain surrounding the alveolus that increases in severity during a period of 1-3 days after tooth extraction, followed by partial or complete loss of the initial blood clot in the interior of the alveolus (socket) with or without halitosis.\textsuperscript{1,3,4} This occurs when initial clot formation fails to mature and the normal socket healing sequence fails.\textsuperscript{5,6} The normal socket healing sequence occurs following removal of a tooth with formation and contraction of the blood clot. Angioblastic ingrowth occurs through the clot and over the intra-oral aspect of the clot, epithelial migration progresses. Fibroplasia of the clot ensues with cellular elimination of fibrin and blood debris with eventual osteoid formation being generated from locally induced mesenchymal cell activity with eventual woven bone formation and through osteoblastic/osteoclastic activity, mature bone is finally formed.\textsuperscript{6}
Prevention of LO and the accompanying post-operative pain can be very frustrating to manage as well as detrimental to the social/physical well being of patients. Prevention of LO has been studied over the years and the etiology has been associated with trauma during extraction, local anesthetics with vasoconstrictors, oral contraceptive use, gender, tooth location, smoking, and operator skill.\textsuperscript{2} Preventative treatments have ranged from altered surgical technique to medicaments placed within the socket at the time of surgery (Gelfoam saturated with Cleocin, Gelfoam with Tetracycline, Tetracycline alone, Terra-Cortril on Gelfoam, Chlorhexidine rinses or gel, thorough saline irrigation, and use of activated Platelet Rich Plasma).\textsuperscript{2,11-13,16} Dr. Joseph Choukroun of France, advocated the use of a platelet concentrate autogenous material (Platelet Rich Fibrin- PRF) in dental extraction sties to expedite socket healing and reduce post-operative pain.\textsuperscript{7} The accelerated healing capability of PRF stems from its content of the same growth factors found in another platelet concentrate, Platelet-rich plasma. The technique used to produce PRF also imparts the desirable additive feature of a pliable, suturable fibrin mesh.\textsuperscript{8} The use of Platelet Rich Fibrin offers a biologic approach to prevention of localized osteitis, expediting healing of the extraction site and in-turn decreases post-operative pain and the adverse sequel subjected to our patients who develop localized osteitis.

The use of PRF applications within oral and maxillofacial surgery was first described by Dr. Joseph Choukroun, and he collected autogenous whole blood in standard blood tubes and centrifuged the blood sample and as a result of this technique, a fibrin clot is produced that is rich in platelets.\textsuperscript{7} This fibrin clot is placed within extraction sites and the fibrin clot can be molded/compressed by expressing out platelet poor plasma to either use as the sole biologic material placed in the socket or can be used as a fibrin “cap” over site preservation material.\textsuperscript{10}

Platelets contain alpha granules which upon degranulation, release cytokines able to stimulate cell migration and enhance cellular level events to expedite wound healing. These cytokines have been well described and include: TGF\textsubscript{b}-1 (Transforming growth factor-beta) is a morphogen that can stimulate osseous cellular activity; PDGF (Platelet Derived Growth Factor) regulates the migration and proliferation of mesenchymal cells in the vicinity of the extraction site to stimulate osseous, endothelial and fibroblastic proliferation; VGEF (Vascular endothelial growth factor), EGF (Epithelial Growth Factor) and IGF’s (Insulin like growth factors) aid in the proliferation and differentiation of numerous cell types.\textsuperscript{8,15}

Angiogenesis, natural support of immunity and wound coverage are the keys of soft tissue maturation as described by Choukroun. He described PRF as a natural fibrin based biomaterial favorable to microvascularization, as a guide to epithelium migration, as well as provides protection of open wounds and accelerates wound healing. The initial organized fibrin matrix of PRF has been described to direct stem cell migration and provides the ideal support for transplanted mesenchymal cells for obtaining osseous defect regeneration and seem to be ideal for improving initial third molar site wound healing, clot stabilization and prevention of localized osteitis.\textsuperscript{10,14,15}
MATERIALS AND METHODS

Patient Selection

Eighty four patients underwent removal of indicated bilateral lower wisdom teeth from August 2011 to February 2012 by two different oral surgeons. Each surgeon performed 42 consecutive wisdom teeth removal cases. Our control group consisted of the previous 84 consecutive patients who underwent lower wisdom teeth removal without placement of PRF in the lower third molar surgical site from June 2011 to August 2011.

Surgical procedure

The surgeries were performed under general anesthesia with local anesthesia and the PRF clot was placed only in the lower third molar sites bilaterally. A standard buccal flap with disto-buccal releasing incision was instituted when necessary. The blood draws were accomplished following placement of a 22 or 20 gauge angiocatheter and then a Sureflo injection plug was placed on the angiocatheter. Either a 10 cc syringe or a 21 gauge Terumo blood collection set was used to draw off whole blood (8.5-10 cc per Red top DB Vacutainer) captured in 2 different Red top (non-citrate containing) DB Vacutainer blood tubes. The blood tubes were then placed in a standard medical centrifuge for 10-12 minutes at approximately 2700 RPM. The wisdom teeth, including the lower third molars, were removed and the PRF clot was withdrawn from the blood tube using long, thin forceps. Most of the attached red blood cell “tail” was removed from the bottom of the PRF plug and then the PRF plug was placed in each of the lower third molar extraction sites with the “buffy coat” side facing upward. The surgical site was closed using 3-0 chromic gut sutures. Primary Closure was not always obtained (or attempted) depending on the pre-existing location of the lower third molar. The patients received pre-operative IV antibiotics and steroids (Decadron). Post-operative narcotic analgesics (Vicodin/Percocet) were prescribed and the majority received post-operative oral steroids (Decadron, 4 mg PO Q 8 hours x 6 doses). The patients received standard post-operative instructions, including use of OTC NSAID’s in combination with narcotic medications (as needed) and to maintain the lower third molar site hygiene with use of OTC antimicrobial mouth rinses for a one minute rinse at least twice a day. All patients were accessed for localized osteitis within 7-10 days of the surgical procedure.

PATIENT DEMOGRAPHICS

PRF Patients:

Age range of the patients: (ages 14-20, #48) (ages 21-25, #18) (ages 26-30, #4) (ages 31-35 #7) (ages 35-40, #3) (ages 41+, #4)

Males/Females: 45/38
Smokers/oral tobacco users: #9
Oral Contraceptive Steroid use- #5
Patients receiving additional narcotic prescriptions: #12
Patients receiving additional steroid prescriptions: #10
Pre-operative lower third molar site evaluation:
   History of Pericoronitis: 4 sites
Fully erupted: 29 sites  
Soft tissue impacted: 4 sites  
Impacted (Partial bony): 65 sites  
Impacted (Complete bony): 67 sites  

NON-PRF Patients (control group):  
Age range of the patients:  (ages 14-20, #54 ) (ages 21-25, #20) (ages 26-30, #8) (ages 31-35 # 1)  
(ages 35-40, #1) (ages 41 +, # 0)  
Males/Females: 44/40  
Smokers/oral tobacco users: #3  
Oral Contraceptive Steroid use- #4  
Patients receiving additional narcotic prescriptions: # 12  
Patients receiving additional steroid prescriptions: # 8  
Pre-operative lower third molar site evaluation:  
   History of Pericoronitis: 4 sites  
   Fully erupted: 12 sites  
   Soft tissue impacted: 4 sites  
   Impacted (Partial bony): 62 sites  
   Impacted (Complete bony): 90 sites  

RESULTS  
The third molar sites containing PRF, whether the wound margins were approximated or not, revealed complete coverage of alveolar socket wall. Minimal bleeding occurred from the surgical sites once PRF was placed and latent hemorrhage did not occur. All patients encountered “normal” post-operative discomfort which was managed with prescription and nonprescription medications discussed at the pre-surgical evaluation. The control (non-PRF) group had LO develop in 14 of the 168 sites which equates to a 8% localized osteitis incidence. The placement of PRF within 168 lower third molar surgical sites resulted in zero incidence of localized osteitis. The prevention of LO occurred irrespective of tooth position (difficulty), age, gender, smoking history, or use of oral contraceptive steroids.  

Conclusion  
The preventative of localized osteitis using PRF was predictable within the small patient sample size of this study. The application of PRF was simple to use and extremely cost effective (28 times less expensive than activated Platelet Rich Plasma) which increases the appeal for standard usage during third molar surgery. This preventative technique also uses an autogenous soluble biologic material which does not introduce foreign material into the surgical site and predictably prevented the occurrence of localized osteitis within lower third molar surgical sites.
REFERENCES: