

Dr. Gallagher , Oral and Maxillofacial Surgeon, presents

Practical Practice Pearls

For Dental and Medical Professionals

This newsletter is published monthly and contains useful information about current pharmacology and therapeutics, pathology, techniques, and procedures used for the management of diseases and conditions of the hard and soft tissues of the face and mouth. Please contact us to be added or removed from our fax list, and/or with your comments and suggestions for "Pearl Topics". Copyright 2003 by Dale M. Gallagher, DDS, PA, 12210 Pecan Street, Austin, Texas 78727 phone: 512 258-1636; fax: 512 258-6352; email: dgallagher@jawpain.com

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Platelet Rich Plasma (PRP)

Wound healing is accelerated with platelet rich plasma (PRP), and when it is mixed with bone grafting materials (autologous and/or banked bone), the graft sites heal rapidly, solidly, and predictably. Every dentist should know how PRP works, its indications for use, and how to select patients that can benefit from it.

Platelets perform many functions following injury and during tissue repair. Hemostasis involves platelets, and we are familiar with the coagulation process. However, what is less well understood (and the focus topic here) is how the platelets promote wound healing. Platelets contain many growth factors including platelet derived growth factor (PDGF), transforming growth factor beta 1 (TGF-b1), and transforming growth factor beta 2 (TGF-b2). PDGF induces mitogenesis (increased healing cell populations), angiogenesis (endothelial mitosis into functional capillaries), and macrophage activation (debridement of the wound site and a secondary source for wound repair and bone regeneration). TGF-b is a superfamily that contains at least 13 types of bone morphogenic proteins (BMP) which enhance chemotaxis and mitogenesis of osteoblast precursors, and they also have the ability to stimulate osteoblast deposition of the collagen matrix of wound healing and bone.

When a bone graft is placed (into a sinus lift, osseous defect, tooth socket) it occupies a space filled with clotted blood that is hypoxic, acidotic, and contains platelets, leukocytes, red blood cells, and a complex fibrin clot adjacent to transferred osteocytes, osteoblasts, and stem cells. Initiation of bone regeneration starts with the release of PDGF and TGF-b from degranulation of platelets in the graft. Their activities (see paragraph above) begin immediately upon wound closure, and by the third day capillaries begin to penetrate the graft. Complete capillary permeation of the graft occurs by day 14-17. This initial flurry of cellular repair/healing activity is primarily the direct result of PDGF and TGF-b. Whereas platelet life span and the direct influence of its growth factors is only about 5 days, healing and bone regeneration is accomplished by: 1, increasing and activating marrow stem cells into osteoblasts (which secrete TGF-b), and 2, the chemotaxis and activation of macrophages which replace the platelets as the primary source of growth factors after the third day. Macrophages secrete PDGF and stem cells secrete TGF-b to continue a self-stimulation of bone formation as an autocrine response. That is, the platelets "jump-start" the healing process until macrophages and stem cells take over. Therefore, if the number of platelets in a wound is increased, then healing should be accelerated.

Platelet rich plasma (PRP) is made from a patient's own blood, and takes about 20 minutes to process in the operatory next to the patient. The drawn blood is anticoagulated and centrifuged to separate the cells from plasma. The concentrated platelets with WBCs and some RBCs are extracted, coagulated, and mixed with a bone graft (autologous and/or banked bone). The PRP graft is semisolid (somewhat like Jello or soft Fruit Roll-Up) and can easily be placed

into a bony defect, sinus, or other graft site. The PRP without the bone graft can be sprayed onto soft tissues, onto a graft, or over an incision to accelerate healing at almost any location. Yields: 20cc and 50cc of drawn blood yield about 3cc and 7cc of PRP, respectively. PRP platelet concentrations exceed 4x to 5x above levels needed to enhance wound healing.

That is the science, here is the clinical part: PRP is safe (patients receive their own blood), quick to prepare, and relatively inexpensive. Most importantly, it has many clinical applications, and may be expected to induce bone repair beyond that expected by bone grafts lacking PRP. Here is where PRP bone grafts are particularly useful:

Sinus lift grafts. Sinus grafting with PRP yields very solid bone that is ready to accept implants in 6 months.

Alveolar defects. The deficient alveolus can be augmented in height and width by a PRP bone graft. A membrane barrier can be used with PRP grafts. The alveolus will be ready to accept an implant in 4-6 months.

Extraction sockets. PRP placed into tooth sockets following multiple extractions can help maintain and reconstruct a deficient dental arch in preparation for a denture or implants. Also, when elderly patients have difficult extractions (like impacted wisdom tooth removal) PRP accelerates healing and decreases morbidity. Importantly, PRP placed in a third molar socket will prevent or diminish the periodontal defect distal to the second molar!

Orthognathic surgery. PRP placed on the maxillary and mandibular osteotomy sites, with or without bone grafts, significantly limits edema and discomfort, and accelerates bony healing.

Repair of sinus perforations. PRP helps "plug" and enhance wound closure and healing of oronasal and oronasal defects.

Cleft lip and palate repair. PRP is excellent for repair of alveolar cleft deformities, and aiding cleft wound healing.

Hemostasis. PRP may be applied following extraction or soft tissue surgery to enhance coagulation and primary healing in persons with challenged coagulation states or bleeding disorders. PRP can also be used on persons that take anticoagulants (e.g., Coumadin), particularly where discontinuation of the anticoagulant prior to surgery would be ill-advised because of proclivity of stroke or pulmonary embolus during a normocoagulation state.

Patient selection is similar to choosing any bone graft procedure, only more so. Persons who need grafts will heal better with PRP grafting procedures than when PRP is not used. Cases where there is normally reluctance to graft because of age or medical factors (e.g., older persons, diabetics) can often have successful PRP grafts.

This has been a brief introduction to PRP grafting. PRP is a concentration of bioactive proteins that accelerates wound healing and forms the foundation for bone graft tissue engineering by improving the handling characteristics of graft material, facilitating fixation of the graft material to the surgical site, and optimizing conditions for healing. "Think PRP" the next time you have a patient that needs a bone graft, or may benefit from accelerated tissue healing.