"Autologous Platelet Rich Plasma" (*Platelet Gel*) was developed in the early 1970's as a by-product of multicomponent pheresis. Techniques and equipment have dramatically improved through the 1990's. This is a new procedure which utilizes the patient's own (autologous) platelets. Briefly, here's how the procedure works:

One unit of whole blood (approximately 450 milliliters) is drawn, either pre-operatively or in the Operating Room, into a standard blood collection bag containing a citrate-phosphate-dextrose anticoagulant. There are also new machines that are able to utilize as little as 50 milliliters of blood to produce *Platelet Gel*. The blood is then centrifuged by using a variable-speed centrifuge autotransfusion machine or portable machine, to separate the buffy coat suspended in plasma from the red blood cell pack and platelet-poor plasma fraction. This is the platelet concentrate used for *Platelet Gel*. Depending on the initial platelet counts, it is common to achieve platelet counts in excess of over three to five (3-5) times baseline counts. Other important factors in quality of *Platelet Gel* are platelet viability and percent retained on the procedure. While white cell content increases 125% with selection for lymphocytes and monocytes, the inclusion of platelets and white cells appears to have several beneficial aspects. White cells confer additional healing cytokines while providing antibacterial activity.

On activation with thrombin/calcium to form a coagulum, the platelets interdigitate with the forming fibrin web, developing a gel with adheriveness and strength materially greater than the plasma alone. Thrombin/calcium also causes platelets to immediately release highly active vasoconstrictors, including beta thromboxane, serotonin and PDGF.

Related Reference Articles to Thrombin:


In addition, platelets contain many tissue growth factors. These predominant growth factors are:

- **PDGF (Platelet Derived Growth Factor)** - PDGF is a very powerful regulatory growth factor and a sentinel growth factor that begins nearly all wound healing. PDGF's main function is to stimulate cell replication (mitogenesis) of healing capable stems and premitotic partially differentiated osteoprogenitor cells which are part of the connective tissue-bone healing cellular make-up. PDGF also causes replication of endothelial cells, causing budding of new capillaries (angiogenesis). PDGF exists in three forms: PDGFaa, PDGFbb, PDGFab.
Differentiation of multiple cell types. TGF found in platelets is subdivided into TGFβ1 and TGFβ2, which are the more generic connective tissue growing factors involved with matrix formation influencing osteoblasts to lay down bone matrix through the process of osteogenesis. Also cells activated by TGFβ1 and TGFβ2 include fibroblasts, endothelial and osteoprogenitor cells, chondroprogenitor cells and mesenchymal stem cells. A condroprogenitor cell will further differentiate and produce the matrix for cartilage. A mesenchymal stem cell stimulated to mitose provides wound healing cells.

Other important growth factors in platelets are:

- **EGF (Epidermal Growth Factor)** - EGF is responsible for cell differentiation and stimulates re-epitheliation, angiogenesis and collagenase activity.
- **IGF (Insulin Growth Factors)** - IGF is also important in wound healing, and stimulates both proliferation and differentiated function in osteoblasts.

There are over 30 known growth factors to date. These **Platelet Growth Factors**:

- Increase tissue vascularity through increased angiogenesis
- Are chemotactic for monocytes, macrophages, and fibroblasts
- Enhance collagen synthesis
- Increase the rate of epitheal and granulation tissue production
- Enhance osteogenesis
- The high concentration of leukocytes in the buffy coat add an antimicrobial effect, while wound hemostasis and lymphatic sealing provide an opportunity to eliminate post-operative drains and reduce pain
- Provides watertight seal for dural closures
- When mixed auto/allograft bone fragments, it forms a putty-like form ideal for packing of structural reconstructions
- Provides for an immediate surgical hemostatic agent that is biocompatible, effective and safe.

Related Reference Articles:


**Autologous Platelet Gel:**

- is safe
- is non-toxic to tissue
- is autologous
- is easily prepared
- is readily available
- is cost effective
- promotes a firm seal in minutes
- is reabsorbed by the body in days to a few short weeks
- promotes local tissue growth and repair

**Autologous Platelet Gel is the Perfect Operating Sealant!**

Autologous Platelet Rich Plasma (Platelet Gel), on activation with thrombin/calcium, is a fibrin tissue adhesive, having hemostatic and tissue sealing properties, but differs from fibrin tissue adhesives (Fibrin Glue) in its ability to improve wound healing and enhance osteogenesis.

**Current Wound Sealants**

Cyanoacrylates have been used in the closure of tension-free wounds, but are limited in clinical applications. The acrylic plastic cyanoacrylates are biodegradable and bacteriostatic, and use of these short chain methyl- and ethylcyanocrylates can result to severe histotoxic responses (neural toxicity). When longer chain butyl- and isobutylcyanocrylates are utilized, there is an increase in inflammatory responses and foreign body giant cell reactions. When neovascularization is compromised through mechanical blockage, normal wound healing is affected. Recently, topical applications of octylcyanocrylates have been used and reported in clinical studies. They have limited usage, and are for external use only.

Fibrin Glue - Some of the first applications of Fibrin Glue are reported by Matras in Vienna. Fibrin tissue adhesives (Fibrin Glue) involve thrombin activation of concentrated fibrinogen with the presence of Factor XIII, the plasma protein Fibrinogen and cold insoluble Globulin Aprotinin.
Calcium Chloride.

The commercial preparation of Fibrin Glue involves cryoprecipitation of Fibrinogen from single donor or pooled homologous human blood by adding calcium and thrombin at the time of usage. A fibrin clot is produced.

Commercial preparations currently under the brand name Tissel™ (Baxter AG, Deerfield, IL) use purified clotting factors derived from pooled homologous human blood products. They have been virally inactivated by heat vaporization or solvent detergent methods. These preparations contain high concentrations of fibrinogen (70-140 mg/ml). Also Fibronectin, Factor XIII and antifibrinolytics may be included.

Also a fibrin sealant, Hemaseal® has been licensed for use in the United States. In addition, autologous cryoprecipitated fibrinogen preparations have been employed in the United States.

Related Reference Articles:

- Wilson, S.M., Dell, P., Donegan, E.A., HIV Transmission Following The Use Of Cryoprecipitated Fibrinogen and Gel/Adhesive, Transfusion, 1991; 31s:51s.


