

Lyophilized PRP for Clinical Applications

Regenerative medicine and dentistry is rapidly becoming the upcoming scientific field which encourages regeneration of tissue rather ablative surgical procedures. A part of this mechanism is brought about by tissue engineering.

Under the tissue engineering principles, the bony defect in the jaws is being regenerated in extracted sockets for implant placement, for treatment of intra bony defects as well as pathological defects of the jaws. For the tissues to be regenerated, we need cells and growth factors. The most important cocktail of growth factors now used and practiced in

dentistry is from platelet rich plasma (PRP) or from platelet rich fibrin (PRF).

There are many studies that confirm that growth factors are playing a vital role in injury

Lyophilisation is a dehydration process typically used to preserve a perishable material or make it more convenient for transport

recovery, healing of wound, in bone regeneration etc. Though there are reported positive results with PRP, few studies on PRP have demonstrated limited positive clinical results. The reports of says that ordinary centrifuge to develop PRP, which are mainly developed for diagnostic purposes are not for PRP processing and hence may not produce a sufficient platelet yield.

Autologous PRP

Use of PRP in an autologous form is practiced in many parts of the world for bone regeneration. Even though few randomised studies showed positive results with autologous PRP, many trials are not encouraging. Since then people switched to PRF applications. Failures of autologous PRP are due to the following reasons.

- ⊙ PRP has to be activated with bovine thrombin or calcium chloride. The bovine thrombin can produce anaphylactic reactions.
- ⊙ PRP preparation is not based up on the quantification of the growth factors from the patients' collected blood sample. Also it cannot be practically possible in the present form.



- ⊙ Periodontal surgery
- ⊙ Pulpotomy agents in primary tooth

Medical applications of PRP powder

Orthopedics

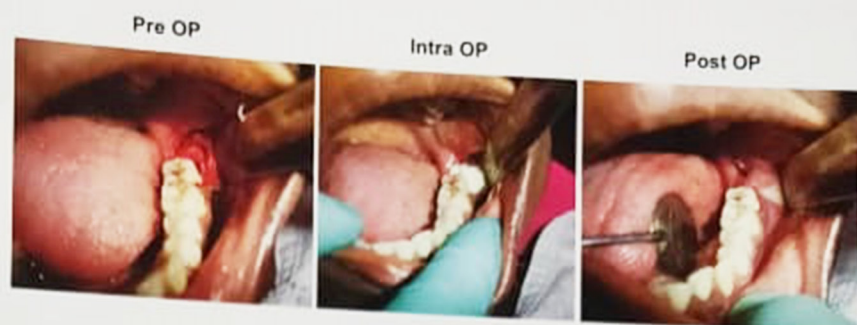
- ◇ Osteoarthritis
- ◇ Rotator cuff tears
- ◇ Chronic plantar fasciitis
- ◇ Ligament injuries
- ◇ Pelvic pain and instability
- ◇ Back and neck injuries
- ◇ Elbow and ankle sprains
- ◇ Tendonitis
- ◇ Bone repair and regeneration
- ◇ As an adjuvant in cell based therapy

Vascular complications

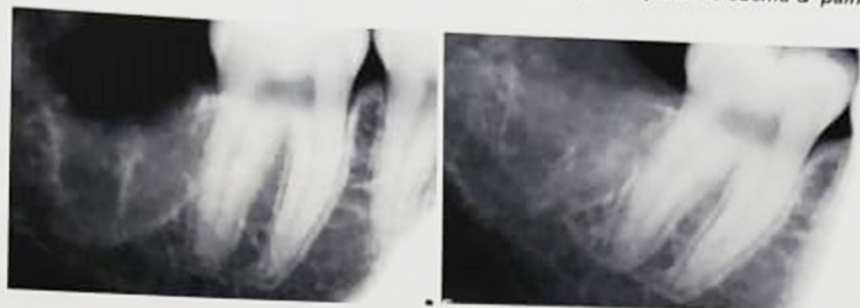
- ◇ Chronic ulcers
- ◇ Diabetic foot
- ◇ Diabetic neuropathy

Cosmetics

- ◇ Vampire face lifting



It prevents post operative edema & pain



Application of PRP Powder After removal of impacted 3rd molar

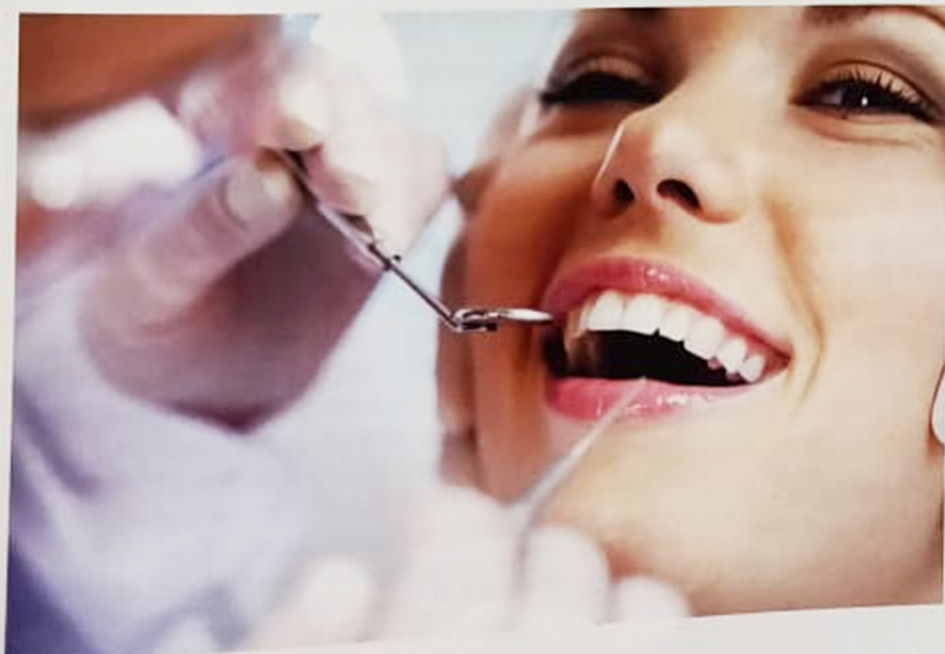
- ◇ Skin rejuvenation
- ◇ Active acne and scar revision
- ◇ Adjuvant in Laser toning
- ◇ Adjuvant in pigmentation treatment
- ◇ Blemish treatment

Conclusion

PRP is being used for a variety of treatments in the medical and dental field. But in many cases due to improper administration (without following proper procedure), it has led to wide spread failure in treatment.

Autologous preparation of PRP has also proved to be time consuming, costly and less effective. It is also not possible to quantify the content of different growth factors during the procedure. Similarly, when quality centrifuging facility is not available, the procedure is less effective.

To increase the probability of success, it is essential to lyophilize PRP and quantify the same. Lyophilisation aids in quantification of various growth factors in PRP, increases its life span, reduces cost and improves sterility. This helps the availability of Off-the-shelf growth factors with cheaper price. [E]



products, such as vaccines and other injectables.

Lyophilised PRP is done after activation of platelets. Activation of this product is by freeze thawing method thereby breaking the platelet membrane and thus growth factor is released. By this method of activation, there is no addition of external factors like calcium chloride or xenobiotic compounds like bovine thrombin. Once activated the sample is freeze dried and the dried powder is sent for sterilisation and quantified for the growth factors present in them.

Advantages of Off the Shelf PRP (Powder)

- ⊙ No allergies
- ⊙ Longer shelf-life
- ⊙ Colour-slight yellow
- ⊙ Instantly dissolves in sterile or saline water
- ⊙ Already sterilised and devoid

of blood pathogens (HIV/ HBsAg/ HCV etc.)

- ⊙ Anti-inflammatory
- ⊙ Haemostatic
- ⊙ Osteoinductive-Enhances osseointegration of implants
- ⊙ Quality and quantity cross checked with preparation
- ⊙ Adequate amount of growth factors are present
- ⊙ Dosage can be determined
- ⊙ Can be stored for multiple applications and longer duration
- ⊙ Can reduce or avoid drugs
- ⊙ Readily available for off the shelf use

Already available lyophilised human allogenic plasma product for clinical use in the global market

- ⊙ **LYOPLAS-N** (Zentralbereich Plasma, Germany)

- ⊙ **PLYO** (French Lyophilised Plasma, Department of Defence, France)
- ⊙ **PRP Powder** (Institute for Transfusion Medicine, University of Rostock, Germany)

Dental application of PRP-Powder

- ⊙ Haemostasis
- ⊙ Periodontal bone regeneration
- ⊙ Mandibular 3rd molar removal
- ⊙ Enhances soft tissue and bone regeneration
- ⊙ Osteoinduction-enhances osseointegration of implants
- ⊙ Graft with PRP-P
- ⊙ Facial rejuvenation
- ⊙ Medically compromised patient
- ⊙ Pregnant patient



Intra OP



PRP + Graft



Immediate Post OP



Pre OP X-ray



Post OP

Application of PRP in Cyst



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- ⊙ There is lot of variation in the growth factors depending upon the age and gender.
- ⊙ We need to optimise the level of growth factors (proteins) for osteoblast or fibroblast multiplication. Overdose or underdose of growth factors do not produce any clinical outcome or suppress the growth of cells. So dose and type of growth factors play an important role in curing or reversing the pathology.

So the limitations of autologous PRP in the present form are as follows:

- ⊙ Need a sophisticated centrifuge (Most clinics use the diagnostic type)
- ⊙ Need trained paramedical staff and lab facility/technicians
- ⊙ Preparation is not yet standardised
- ⊙ Blood should be obtained from the individual

- ⊙ PRP should be activated before use
- ⊙ Cannot be stored for multiple applications
- ⊙ May not get adequate amount of growth factors from diseased patients
- ⊙ Costly affair

Lyophilised PRP (Off the shelf PRP)

Platelet-rich Plasma (PRP) is a concentrate of platelet-rich plasma protein derived from whole blood, centrifuged to remove red blood cells (RBCs). Freeze-drying is technically known as Lyophilisation or Cryodesiccation. It is a dehydration (dry by freezing in a high vacuum) process typically used to preserve a perishable material or make it more convenient for transport. Pharmaceutical companies often use freeze-drying to increase the shelf life of the