
REFERENCES

1. Atanasov D. Urgent and emergency dental services. *ORMED*, Sofia, 2003:230-240.
2. Ivanov S. Local anesthesia. Teeth extraction and root amputation. Sofia 2003:43-44.
3. Michen J. Local anesthesia in dental practice. *Sharov*, Sofia 2003:35-36.
4. Polichronov N, et al. Propedeutics of dental and maxillofacial surgery. *Polichronos*, Sofia 1999.
5. Cholarski V, et al. Internal medicine for dental students. *Med y Fizyk So-fia*;1999
6. Amado-Cuesta S, Valmaseda-Castellon E, Berini-Aytes L, Gay-Escoda C. Complications of ambulatory oral surgery in patients over 65 years of age. *Med Oral* 2004; 9:253-62.

Address for correspondence:

Hristina Lalabonova, Ph.D., MD
Department of Oral Surgery, Faculty of Dentistry
Medical University-Plovdiv
24 , Veliko Tarnovo Str., 4000 Plovdiv, Bulgaria
Mobile: +359/888 608 406; e-mail: lalabonova@abv.bg

Journal of IMAB - Annual Proceeding (Scientific Papers) 2005, book 2

OPPORTUNITIES THE USE OF PLATELET-RICH PLASMA PRESENTS FOR INCREASING OSTEOGENESIS IN ORAL SURGERY

Chenchev Ivan
*Department of Oral Surgery, Faculty of Stomatology,
Medical University, Plovdiv*

Preview: The purpose of the following resume is to introduce the effects of using platelet-rich plasma for boosting the bone formation when added to various bone, and bone replacing materials. It also deals with the characteristics of the platelet-rich plasma. Further, a review of many articles dealing with the above-mentioned issue is presented, with the conclusion that adding platelet-rich plasma in bone and bone replacing materials can significantly improve the healing process of bone and gum tissue in the surgically treated area.

Key words: platelet-rich plasma, growth factors, new-bone formation

The purpose of the following survey is to introduce the effects of using platelet-rich plasma / PRP / for boosting the new bone formation. Recently in the field of the contemporary stomatology and particularly in the field of the oral surgery new technologies and materials came in, creating new opportunities in the treatment of the different no-zological units.

New bone formation requires sufficient amount of osteogenous cells-predecessors capable of securing the formation of the desired bone. The transplantation field has to

be filled with matrix, which facilitates the attachment and the differentiation of the osteoblastic precursor cells. It is also necessary these cells to be stimulated by growth factors helping the formation of the favourable phenotype cells. /6/ The other critical moment in the formation of a new bone is the formation of new blood vessels /angiogenesis/. /6/ The choice of bone-replacing materials includes autogenic bone, taken from the patient from different parts of the body /close or distant/. They can be cortical and spongyous. Alobone grafts taken from the same or other person. They are freeze-dried mineralized bone /FDMB/ and freeze-dried demineralized bone /FDDB/ Xenobone materials are taken from different parts of other species / most common from mammals or from the exoskeleton of a coral/. The aloplastic bone substitutes are synthetically obtained and differ by their crystal size /hydroxylapatites(HA) and tricalciumphosphate ceramics (β TCP)/.

The perfect Bone Replacement Graft Material-BRGM has to have the following features: osteogenesis, osteoinductivity and osteoconductivity. /15/ The osteogenesis is a process in the course of witch a new bone is formed directly from the osteoblasts. The osteoinductivity is the

ability of the bone substitute to transform the mesenchymal cells into osteoblasts and by these means to lead to a new bone formation. Osteoinductivity is a process allowing bone apposition from the stimulation of the existing /present/ surrounding bone. For the present is considered that only autogenic bone substitutes possess partially all the three features and thus the autogenic bone is considered a “gold standard” among the bone-substitution materials. /9/ Despite that the research and the production of new bone-substitution materials continues, as well as the development of the existing ones. The main reason for that is the effort to avoid a double trauma of the patient and the promising features of the nonautogenous substitutes.

The platelet-rich plasma is a product, which is a concentration of platelets in a small volume of plasma. /8/ The platelets produce the following growth factors: /PDGF/- Platelet-Derived Growth Factor, / TGF- β -/ Transforming Growth Factor- β , / VEGF/ -Vascular Endothelial Growth Factor, /IL -I/ - Interleukin-I, /BFGF/ - Basic Fibroblast Growth Factor, /IGF/ - Insulin - like Growth Factor. /2/ In the rich of platelets plasma there are also small amounts of immune-component cells and plasma. /8/

The PDGF- is a basic dimeric glycoprotein with two disulphide-bonded polypeptides referred to as A and B chains. Isoform PDGF are possible – AA; BB and heteroform AB. All the isoforms activate after the platelets are adhered in the wound. /2/ In vitro PDGF allows the formation of periodontal ligament of fibroblast cells and helps the synthesis of collagen and proteins. AA and BB isoforms increase the proliferation of bone cells.

The IGF has two forms I and II. They are single-chained peptides that bind with some insulin receptors and participate in the formation of numerous tissues, including teeth. IGF I stimulates the bone formation, proliferation and differentiation. /4/ The increasing activity of human osteoblasts was displayed after the combination of PDGF, IGF, TGF- β and EGF /Epidermal Growth factor/. People treated with recombination PDGF-BB and rhIGF-I and methylcellulose as a host, showed 43.2% sealing of the bone defects compared with 18.5% in the control group. /5/

TGF- β is a homodimeric proteins, participating in the formation and development of numerous tissues. TGF- β is used separately and in a combination with PDGF-BB to activate the fibroblasts. TGF- β stimulates the biosynthesis of collagen I-type, fibrinectine and induces the deposition of bone matrix. /3/ In other researches the application of TGF- β led to substantial increase of the bone regeneration in oral bone defects. /11/

An easy way to obtain growth factors in high concentration is to make platelet-rich autologous plasma. The use of growth factors contained in PRP is known to medical science and is used in different surgical interventions including the oral surgery.

In 1982 it is mentioned by Matras H. for the first

time in maxillofacial surgery about the great potential of a platelet product /fibrin glue/. He uses a combination of bone transplant and fibrin clay to treat big odontogenic cysts. In 1994, Tayapongsak P. et al. suggest adding autogenous fibrin clay to a spongy bone in large reconstructions of lower jawbone defects. In 1998, Marx R. et al. publish a methodology for extraction of autogenic platelet-rich plasma. /7/ They suggest the use of PRP together with autogenous spongy bone. According to Marx R., the platelet-rich plasma on its own does not have osteoinductive effect. It does not induce the formation of a new bone without the presence of bone cells. Such osteoinductive potential has only the bone morphogenetic proteins /BMP- Bone Morphogenetic Proteins/, which are capable to produce a new bone *de novo*. /8/

Many researches confirm that the adding of platelet-rich plasma to bone and bone-substitution materials may lead to the increasing of the size and the rate of bone formation. Indisputable positive effect from the adding of PRP is observed when an autogenic bone is used. /15/

According to some researchers, the use of PRP does not show the expected good results because the effect of the containing PRP is short and continues for about 24-48 hours after their implantation. /15/

Numerous researches have been made in the last years to show the possibility of PRP to increase bone formation in combination with non-autogenic bone substitutes like different allogenic /FDMB, FDDB/ /1/, xenogenic / ABM-Anorganic Bovine-derived Bone Material/ /16/ and alloplastic materials / β -TCP/ /15/. Part of the researchers confirms the positive effect of PRP in combination with allogenic, xenogenic and alloplastic materials, but they do not indicate statistically considerable values. /1, 13, 14/.

Wiltfand J. et al. consider that the adding of platelet-rich plasma to a xenobone is not effective and there is no additional benefit from it. /15/

In the end, we could make the following conclusions:

1. The adding of platelet-rich plasma to autogenic bone has an undisputable result and leads to the increase of the formation of a new bone and helps the healing of the soft tissues in the augmentation area, which leads to better results in oral, maxillofacial surgery, parodontal surgery and implantology.

2. The adding of platelet-rich plasma in combination with allogenes, xenogenes and alloplastic materials leads to better results, but data is statistically unreliable in most of the researches.

3. The presence of some controversial results gives us a reason to support the suggestion of other researchers / 15/ that additional scientific research is needed to reveal the potential of the platelet-rich plasma in combination with different bone and bone-substitution materials finally leading to the standardization of the procedure.

REFERENCES:

1. Adhaloo T L, Moy P K, Freymiller E G. Evaluation of platelet-rich plasma in combination with freeze-dried bone in the rabbit cranium./A pilot study./ Clin. Oral Impl. Res, 2005 Apr; 16(2):250-7.
2. Cochran DL, Rouse CA, Lynch SE, Graves DR. Effect of platelet-derived growth factor isoform on release from neonatal mouse calvarine. Bone 1993; 14(1): 53-58.
3. Dennison DK., Vallone DR., Pinerro GJ., Rittman B., Caffesse RG. Differential effect of TGF- β and PDGF on proliferation of periodontal ligament cells and gingival fibroblasts. J. Periodontology 1994; 65(7): 641-8.
4. Hock JM., Centrella M., Canalis E. Insulin-like growth factor-I Has independent effects on bone matrix formation and cell replication. Endocrinology 1988; 122(1): 22-7.
5. Howell TH., Fiorellini JP., Paquette DW., Offenbacher S., Giannobile WV., Lynch SE. A phase I/II trial to evaluate a combination of recombinant human platelet-derived growth factor-BB and recombinant human insulin-like growth factor-I in patients with periodontal disease. J. Periodontol 1997; 68(12):1186-93.
6. Luboshitz J, Berger U, Yaari Q, Weissman A, Moshonov J. Platelet-rich plasma as adjuvant tool for bone augmentation. Refnat Hhapeh Vahashinayin 2004, Jan; 21(1): 63-70/103
7. Marx RE., Carlson ER., Eichstaedt RM., Schimmele SR., Strauss JE., Georgeff KR. Platelet-rich plasma: Growth factor enhancement for bone grafts. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1998 Jun; 85(6):638-46.
8. Marx RE. Platelet-rich plasma (PRP): what is PRP and what is not PRP? Implant Dent. 2001; 10(4):225-8.
9. Nkenke E., Weisbach V., Winckler E., Kessler P., Schultze-Mosgau S., Wiltfang J., Neukam FW. Morbidity of harvesting of bone grafts from the iliac crest for preprosthetic augmentation procedures: a prospective study. Int J Oral Maxillofac Surg. 2004 Mar; 33(2): 157-63.
10. Piche JE., Graves DT. Study of the growth factor requirements of human bone-derived cells: a comparison with human fibroblasts. Bone. 1989; 10(2):131-8.
11. Hock JM., Canalis E. Platelet-derived growth factor enhances bone cell replication, but not differentiated function of osteoblasts. Endocrinology. 1994 Mar; 134(3): 1423-8.
12. Schliephake H., Bertran H., Liudersmaier W., Mayer H., Planck H. In vitro engineering of human bone marrow derived mesenchymal stem cells (MSC) for tissue engineered growth of bone. Int. Oral Maxillofac. Surg. 1999; 28; (Supple): 107.
13. Velich N., Kovacs K., Huszar T., Semjen G., Reiczigel J., Szabo G., Suba Z. The effect of platelet-rich plasma on new bone formation by augmentation with osseointegrative bone substitute material in beagle dogs. Fogorv Sz. 2004 Feb; 97 (1): 23-7.
14. Wiltfang J., Schlegel K. A., Schultze-Mosgau S., Nkenke E., Zimmermann R., Kessler P. Sinus floor augmentation with beta-tricalciumphosphate (beta-TCP): does platelet-rich plasma promote its osseous integration and degradation? Clin Oral Implants Res. 2003 Apr; 14(2): 213-8.
15. Wiltfang J., Kloss FR., Kessler P., Nkenke E., Schultze-Mosgau S., Zimmermann R., Schlegel KA. Effects of platelet-rich plasma on bone healing in combination with autogenous bone and bone substitutes in critical-size defects. An animal experiment. Clin Oral Implants Res. 2004 Apr; 15(2):187-93.
16. Yildirim M., Spiekermann H., Handt S., Edelhoff D. Maxillary sinus augmentation with the xenograft Bio-Oss and autogenous intraoral bone for qualitative improvement of the implant site: a histologic and histomorphometric clinical study in humans. Int J Oral Maxillofac Implants. 2001 Jan-Feb; 16(1):23-33

Address for correspondence:

D-r Ivan Chenchev
Department of Oral Surgery, Faculty of Stomatology,
Medical University, Plovdiv
24, "Veliko Tarnovo" str.
PLOVDIV-4000, BULGARIA
E-mail: ivan_chenchev@yahoo.com
Mobile: +359/88/8722321