Application of CGF in Dental Clinic

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Abstract

Concentrated Growth Factors (CGF) is a relatively new technology within the area of regenerative medicine. CGF is a blood extract obtained with differential continuous centrifugal technology, containing many kinds of growth factors and fibrins, and able to facilitate the recovery of soft and hard tissues. CGF is different from the methods for producing platelet-rich plasma (PRP) or platelet-rich fibrin (PRF) because no additives are added during its production. Clinical and basic research on CGF are common in foreign countries, but our nation is still only in the beginning phase. In addition to a summary of the methods for producing CGF, this article focuses on the generalization of some skill issues, advantages, and disadvantages of CGF application in clinical practice.

Keywords Concentrated growth factors, Bone regeneration, Cytoskeletons, Blood
Background

Concentrated Growth Factors (CGF) is a biological repairing material, first proposed by Sacco [1] in 2006. CGF is a new generation of blood extracts, following platelet-rich plasma (PRP) [2] and platelet-rich fibrin (PRF) [3]. Able to significantly shorten the time for bone formation osteogenesis in the operational area, CGF improves the quality of the formed bone, and facilitates the formation of bones and the healing of tissues [4-5]. Rich autologous technology takes the venous blood of the patients themselves, to use as the raw material for a special centrifugation production method, thereby reducing the middle step for manufacturing and creating a safe and effective new technology in regenerative medicine. CGF has many growth factors and fibrins, and is able to improve and enhance the regeneration ability of tissues, and also has immunological cells that are effective in regulating inflammation and minimizing the risk of infection [6].

Methods

Theories

The Medifuge hydroextractor has automatic low and high rotation speeds, which cause the thrombocytes in blood to continuously collide and then break, completely releasing the growth factors stored in the blood without the need for chemical substances (e.g. activators). The structure of a CGF blood fibrin molecule is a coupling of three chemical bonds, showing a stereotyped network, which is able to effectively block and accommodate thrombocytes and various kinds of circulating molecules (e.g.cytokines). When CGF is applied to damaged tissues, it facilitates the healing, regeneration, and repairing of the tissues.

Equipment

Medifuge centrifugal machine (Silfradent, Italy)

Operating procedures

Methods for producing rich autologous Concentrated Growth Factor (CGF) fibrin glue

1. Collection of venous blood: 9ml of the patient’s venous blood were put into the vacuette test tubes without any anticoagulation additives. The test tubes could not be shaken and were put immediately into the medifuge centrifugal machine for separation.

2. The CGF program was set up and the centrifugal mode adopted the following data: accelerated for 30 sections so as to reach 2700 rpm, rotated for 2 minutes, then reduced to 2400 rpm, then rotated again for 4 minutes and accelerated to 2700 rpm, rotated for 4 minutes, then accelerated to 3300rpm for 3 minutes, and finally decelerated for 36 seconds and stopped.

3. After 13 minutes of rotation, it could be seen that the contents in the test tubes were divided into three layers: the top layer contained platelet-poor plasma, the bottom layer contained erythrocytes and thrombocytes, and the center layer had CGF glue, rich in growth factors. The plasma was separated out and stored in specific storing containers.

4. The obtainment of CGF glue: CGF glue was taken from the test tubes with tweezers and the two layers were cut off with scissors where the center and bottom layers connected. When the CGF glue was separated out, a quantity of growth factors were located on the interface between the CGF glue layer and the erythrocyte layer. Therefore, a certain amount of erythrocytes had to be retained when doing the separation in order to ensure the content of the growth factors.

5. The CGF glue was pressed in moulds, squeezing the liquid elements within it and obtaining the CGF membrane. The CGF glue and the CGF membrane were put into sterile normal saline for future use.

The CGF was then planted into the operation site

1. The CGF was cut into particles at the size of 1~2 mm with scissors, then the particles were mixed with the collected erythrocytes and the bone substitute materials respectively, after which the materials were stirred with the Medifuge stirrer.
Rotation was conducted for 6 seconds, mixing contents into an even state and creating a dense, paste-like mixture. This mixture was then applied to bone defects. Finally, the site was covered by CGF membrane.

2. The mucoperiosteal flaps on the buccolingual side were separated in a carefully and the wound was stitched closely.

Discussion

Because there was no anticoagulation within the blood sample, centrifugation was conducted immediately after the sampling of the blood, by the Medifuge centrifugal machine being operated according to designed programs. CGF is extremely moldable, and it could be compressed to be used in the form of thin film or used in the form of fragments after being torn, according to the requirements of the operation. During the production of CGF membrane, craping or deformation may occur, so the CGF membrane should be put on the surface of smooth appliances first, in order to preserve the form of the membrane and avoid craping. As for the clinical symptoms to which CGF may be applicable, the only patients that should be excluded are those with abnormal bone metabolism or for whom surgery is not appropriate. Antibiotics should be used before and after the operation, to prevent the infection of the wounds. Like PRP, CGF production is also dependent on separated venous blood. However, the centrifugal speeds of the two technologies are different: PRP adopts the gradient centrifugation technique, while CGF adopts the differential continuous centrifugal technology without needing to add chemicals like activators. As a result, no viral infectious diseases would be incurred. During the regeneration of bone tissues, CGF still needs to mix with autologous bones or bone substitutes as the materials in order to induce regeneration, but this increases the operation site and could create some complications. Some scholars are using CGF and substituting bone transplants for conducting bone reconstruction operations in the maxillary sinus. It is a direction for future research, because currently only CGF can promote the formation of bones without autogenous bones or bone substitutes.

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Competing Financial Interests

The authors declare no competing financial interests.

References