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Progress of concentrated growth factors in the treatment of jaw cysts

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Abstract: *The activation of platelets can release multiple growth factors associated with wound healing and bone regeneration. With the development of autologous platelet concentrate preparation techniques, significant progress has been made in the repair of bone defects in oral and jaw cysts. Concentrated growth factors (CGF)are the latest generation of platelet concentrates obtained by differential centrifugation, rich in growth factors without the addition of anticoagulants, and with no risk of cross-infection and immune rejection. CGF is convenient for material preparation, simple preparation, high efficiency, and has a certain anti-inflammatory effect, and the surrounding soft tissue structure is better recovered. This paper briefly reviews the promoting effect of CGF in the treatment of jaw cysts on soft and hard tissue healing and its related clinical applications, and aims to provide some theoretical basis for the further application of CGF in promoting osteogenesis, which can be better applied in clinical practice and play its maximum value.*

Keywords: *CGF; jaw cyst; osteogenic action; clinical application*

1. Introduction

Jaw cyst is a common disease in oral and maxillofacial surgery, which can occur at any age, with slow growth and no conscious symptoms at the initial stage. If the bone continues to grow, the surrounding destruction may cause infection, root absorption, pulp deterioration, nerve injury and pathological fracture, and even jaw deformity [1]. Maxillofacial cysts include [2] including odontogenic and non-odontogenic cysts with epithelial lining and blood extravasative cysts without epithelial lining, of which odontogenic jaw cysts are more common.Treatment methods for jaw cysts mainly include fenestrated decompression and surgical treatment. Fenestrated decompression is a common conservative treatment used in larger ranges of cysts[3], but the window decompression treatment for a long time, patients need long-term dressing change and repeated washing, some cysts are easy to relapse and need a second operation,and there are some disadvantages like lover pation comliance and not suitable for [4].Surgical treatment is also one of the treatment methods for jaw cysts, used in smaller cysts. Bone defects after surgical treatment are easy to cause infection, lack of bone mass required for tooth repair, affecting the occurrence of the quality of jaw morphology and other complications [5].Therefore, how to effectively repair the postoperative defect cavity and restore the integrity of the jaw has become the focus of clinical treatment of jaw cyst, which also makes the postoperative bone defect repair materials after jaw cyst become a research focus. Concentrated growth factor is a new generation of bone defect repair material in recent years.

Concentrated growth factor (concentrated growth factor, CGF) is a new generation of platelet concentrated products, containing a higher concentration of growth factors than PRP or PRF, simple preparation process, convenient materials, high efficiency, no additional anticoagulant, non-toxic and no cross-infection. And showed the damage to promote the formation of new bone and promote the regeneration of soft tissues. Meanwhile, it helps to reduce the pain and postoperative response to during the healing period[6].CGF is widely used in the oral field, such as implant, dental pulp, periodontal mucosa and maxillofacial surgery [7].This paper reviews the application of CGF in the treatment of jaw cysts and related research progress.

1.1 CGF preparation and use

CGF is a new generation platelet concentrate obtained from differential centrifugation and an

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autologous biological product obtained after centrifugation of peripheral blood centrifugation. Prepared by venous blood centrifugation with alternating and regulated speed using a medical centrifuge, Different centrifugation speeds lead in different types of platelet concentrates, First, according to the size of the lesion, Blood samples (~ 5-15ml) were injected in a sterile centrifuge tube, The centrifuge tube was then immediately placed into a CGF centrifuge, Similar to the procedure for obtaining platelet-rich fibrin (PRF), (Accelerate for 30s, Centrifugation at 2 700 r · min-1 for 2 min, Centrifugation at 2 400 r · min-1 for 4 min, 2 700 r · min-1 for 4 min, Centrifugation at 3 000 r · min-1 for 3 min, Slow down for 36s to stop) to centrifuge [8], After centrifugation, the blood is obviously divided into three layers from top to bottom: 1) the upper part is the platelet-poor serum layer; 2) In the middle is the fibrin gel layer (CGF layer) that gathers platelets and large growth number of factors; 3) The bottom part is the red blood cell layer containing a large number of red blood cells[9].

CGF can be used directly or made into appropriate diameter particles based on the size of the defect, used alone or in combination with other materials, or pressed into a concentrated growth factor membrane to use [10].

1.2 The composition of CGF

CGF is a rich growth factor and fibrin, such as:Platelet-derived growth factor(PDGF),Vascular endothelial growth factor(VEGF)[11],Fibroblast growth factor(FGF)[12],bone morphogenetic protein(BMP),Metastatic growth factor- β(TGF-β1),Metastatic growth factor- β(TGF-β2)[13],Epidermal growth factor(EGF),Insulin-like growth factor (IGF),Angiogenin and interleukin-6(IL-6)[14]and so on There are also CD34+cells[15].

2. Treatment methods for jaw bone cysts

2.1 Open window decompression

Open window decompression ***i***s a kind of minimally invasive treatment, on the surface of the cyst window opening, local open bone and capsule wall make a channel between oral cavity and cavity for cavity fluid drainage and rinse clean[16] relieve the pressure of the cavity, let the surrounding soft and hard tissue slow growth, cavity size gradually smaller, not damage the surrounding tissue structure, and the risk of low treatment of [17].Fenestration decompression is used in large cysts (40mm, more than three teeth), and the healing time depends on the size of the cystic defect; large cysts are longer, with an average of 2-5 years[18]. According to CBCT, judge the size, location, anatomy of the cyst and determine the volume change after decompression. If the cyst damages the surrounding adjacent important tissue, the following alveolar nerve, maxillary sinus, mandible and teeth, to avoid further damage to the surrounding tissue and retain the adjacent tissue structure, the first choice is to choose window decompression [19].Fenestration decompression requires high compliance. After pioneering decompression, the patient is required to change the medicine once every two or three days until the fluid in the cystic cavity is clean. Therefore, so the patient is required to cooperate with the treatment process. Prevent wound healing, deformation or food impaction, with the size of the capsule. The doctor adjusted the size of the plug device according to the change and size of the wound during the observation of each visit. Some patients have local discomfort after wearing the device, which affects the quality of life. Returning patients on time should not be eaten. Some patients need a second operation after the cyst defect reaches a certain degree[4].

2.2 Operative treatment

The removal of the large invalid cavity left after surgery is often the main cause of the delayed wound healing. There are several methods to eliminate the ineffective cavity: blood clot filling, butterfly surgery, biomaterial placement, cyst decompression and plasty, and cystic cavity bone grafting [20].The bone defect has a long recovery time and the postoperative prognosis is poor. Although the human body has a certain ability of self-repair and regeneration, once the bone defect reaches a certain range, it is difficult to restore the original bone physiological structure, affecting the denture repair in the later stage, and even the infection may occur. Therefore, handling the ineffective cavity is important to improve the prognosis of patients with jaw cysts. How to accelerate the repair of bone defects is the focus of oral and maxillofacial surgeons.With the rapid development of materials science, there are many kinds of bone substitute materials, and the range of options for dental doctors is becoming more and more extensive. At present, the commonly used biological materials are: such as

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autograft, xenograft and allograft, and platelet growth factor[21,22].

2.1.1 Bone meal+Self-broken bone

Bio- -OSS bone powder is a common bone substitute.A scholar[23], in 160 jaw cyst patients random method was divided into two groups with Bio-OSS bone powder control group and Bio-OSS bone powder combined with autologous bone crushing experimental group, to observe the incision healing, bone density, bone resorption and attachment loss, etc. At 3 and 6 months after the operation, the BMD in the experimental group was higher than that in the control group.It shows that Bio-OSS bone powder combined with autologous broken bone promotes the repair of bone defects after jaw cyst surgery, accelerates the healing of bone defects, reduces bone absorption, and provides conditions for denture repair of patients. Although autologous bone graft materials are used for bone defects, the disadvantages are the insufficient source of the donor site and the associated complications [24].In addition, Bio-Oss bone powder is expensive, poor acceptance for patients with poor economic conditions, and some patients with fast absorption or bone powder overflow.

2.1.2 Biomembrane+Three calcium sulfate

β -Tricalcium phosphate (β -TCP) has good biocompatibility and biological activity.Some studies reported that [25,26], some patients with jaw cysts used biofilm and biofilm with β -TCP respectively. After surgery, according to the clinical efficacy and imaging analysis, the osteogenic effect of biofilm with β -TCP was significantly higher than that of biofilm group.This indicates that biofilm combined with β -TCP has a good osteogenic effect on the bone defects in the treatment of jaw cysts, and can effectively block the entry of inflammatory cells and promote wound healing, reflecting its value of promoting the repair of new bone in the bone defect area.

2.1.3 CGF

CGF is a kind of biological material, with good biocompatibility, fibrin matrix more stable, the tensile strength and viscosity is higher, most studies show that contains a variety of high concentration of growth factors and fibrin composition fiber scaffold, accelerate cell proliferation, angiogenesis, inhibit osteoclasts, promote osteogenesis such as [14,27].Relevant literature reports that [28], TGF-b1 and VE GF in growth factors, play an important role in stimulating cell proliferation and matrix remodeling during tissue healing.It can be used as a filling material for jaw cysts after surgery, thereby improving bone quality and soft tissue healing. A scholar [29], a 58-year-old male patient with chronic periodontitis found a cyst in the edentulous ridge of the left mandible, and the cyst was removed to CGF, and there was no discomfort at the surgical site. The hard bone defect was found 3.5 months after the operation.70 patients with chronic apical periodontitis were divided into two groups for conventional root canal treatment and apical curettage treatment, and the other group for conventional root canal treatment. Based on apical curettage, the bone resorption, bone mineral density, gray value and periodontal clinical indicators were observed in the two groups.3 months after treatment and 6 months after treatment was significantly lower than that of the control group, and the bone density and gray value were significantly higher than that of the control group, which fully confirmed that CGF rich leukocytes in the bone defects of chronic periapical inflammation had some effective effect on the repair of bone tissue defects and reduced the postoperative response [30].A total of 120 cases from 54 patients with moderate to severe chronic periodontitis were randomly divided into four groups 3,6,9 and 12 months later, and found that the CGF group had good wounds and reduced the depth of the periodontal defect, and CGF had better results in the early stage and was more stable.CGF The unique fibrin network microstructure is a complex three-dimensional structure composed of thin and thick fibrous elements and can also provide a supportive matrix surrounded by multiple platelet cell elements and a variety of cytokines and growth factors. The significant improvement caused by CGF transplantation alone may be due to its biological component and stent structure, which ultimately promotes wound healing and reduces the deep of the periodontal bone defect[31]。The above studies show that the use of CGF alone is not uncommon clinically, such as autologous tooth transplantation, maxillary sinus lifting, impacted tooth extraction, chronic periapical inflammation and small jaw cyst, etc. The growth factors in CGF can activate myocytes, increase myocyte proliferation and fibroblasts, and stimulate the collagen formation of fibroblasts, effectively stimulate the proliferation of osteoblasts, and obviously improve the effect of bone healing.To regulate the survival, growth and migration of immature cells, it plays an important role in accelerating alveolar bone regeneration and promoting the regeneration of soft tissues. In addition, it is conducive to soft tissue healing, but also stimulates angiogenesis, reduce pain and swelling.

Concentrated growth factor as a fibrin scaffold that is considered a stock of natural growth factors

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derived from the patient themselves, nontoxic, no immunogenicity, no immune rejection, no risk of allergic reaction and reduced incidence of infection. Convenient and reliable for clinical use.The gradual release of concentrated growth factors over a period of time can promote the regeneration of alveolar bone, accelerate the better recovery of soft tissue structure, and play a crucial role in the reduction of postoperative recurrence rate. Strong tissue regeneration capacity and biodiversity, stable fibrin matrix, high tensile strength, and abundant osteoblasts. In addition, it helps in nerve repair, reduces pain and postoperative swelling.At present, there are not many studies using CGF alone in the treatment of jaw cysts, and there is a lack of long-term effect clinical experiments, which still need to be further explored.

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