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CASE REPORT

Management of Mandibular Osteomyelitis Combined with Platelet Rich Fibrin (PRF) and Ozone

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ABSTRACT

Osteomyelitis is inflammation of bone tissue which is seen in patient with malnutrition and such systemic diseases caused by decreased resistant to infection. Generally, chronic osteomyelitis is treated with antibiotics and surgical debridement to remove all the dead bone tissue. In this case report, the management of mandibular osteomyelitis which is developed after surgery and application with ozone and platelet-rich fibrin are presented.

Keywords: Osteomyelitis, Ozone, Platelet rich fibrin

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INTRODUCTION

Osteomyelitis is an inflammatory processes accompanied by bone destruction and caused by an infecting microorganism.[1, 2] The infection can be limited to single portion of the bone or can involve several regions, such as marrow, cortex, periosteum, and the surrounding soft tissue.[2] Osteomyelitis may originate from adjacent soft tissues and articulations, hematogenous way, trauma or inoculation of microorganisms into the bone by surgical procedures.[3] There are many types of osteomyelitis: acute osteomyelitis, chronic osteomyelitis, vertebral osteomyelitis, prosthesis-related osteomyelitis, brodie abscess, tuberculosis osteomyelitis, infection of intervertebral disk space (discitis), fungal osteomyelitis and etc[4]. Chronic osteomyelitis is a multifaceted bacterial infection with common features that absolutely requires surgery for remission.[5] Infection formation in bone tissue develops by local causes (trauma) and systemic disease (immune deficiency syndrome, diabetes, malnutrition, chronic diseases, etc.) that reduces immune defence.[1, 6] Mandibular osteomyelitis is generally polymicrobial, the number of microorganisms do not differ aetiology of osteomyelitis and do not effect the changes of recovery.[7]

In general, chronic osteomyelitis is treated with antibiotics and surgical debridement to remove all the dead bone tissue.[8] The optimal management of chronic osteomyelitis includes sequestrectomy, resection of scarred and infected bone as well as soft tissue obliteration of dead space, appropriate bone mechanical stability, adequate soft-tissue coverage, and restoration of an effective blood supply.[9]

Platelet-rich fibrin (PRF) was first developed in France by Choukroun and colleagues.[10] PRF, belongs to a second generation of platelet concentrates and its production protocol attempts to accumulate platelets and the released cytokines in a fibrin clot.[10-12] Recently, PRF has become a valuable adjunct to promote healing in many procedures in dental and oral surgery.[13, 14]

Ozone, in the gaseous or aqueous phase, has been shown to be a powerful and reliable antimicrobial agent against bacteria, fungi, protozoa, and viruses.[15] Ozone stimulates proliferation of immune competent cells and synthesis of immunoglobulins therefore influences cellular and humoral immune system. It also activates function of macrophages and increases sensitivity of microorganisms to phagocytosis. Ozone causes the synthesis of biologically active substances such as interleukins, leukotrienes, and prostaglandins which are beneficial in reducing inflammation and wound healing.[16] In this case report, the treatment results of mandibular osteomyelitis which is developed after surgery and treated with ozone and PRF are presented with literature review.

CASE REPORT

76 year-old patient was admitted to our clinic in May 2014 for discomfort of left mandibular region and inability to use prosthesis. In the history of patient: we learnt that the patient went to another clinic a year ago and vestibuloplasty operation was performed for increasing prosthesis stability. Two operations were performed, because of wound healing complication with an interval of two months. The patient has senile prostatic hyperplasia and diabetes who received insulin treatment.

Intraoral examination of patient, at the top of the left lower jaw edentulous ridge about 1x2.5 cm in size and exposed necrotic alveolar bone structure was observed. Patient had no complaint about

pain and paresthesia. (Figure 1) No lymphadenopathy was observed during extraoral examination, the necrotic bone area was found broader range in panoramic radiographs. (Figure 2) HgA1c =7.1% and fasting blood glucose level= 125mg/dl were determined in blood analyze.

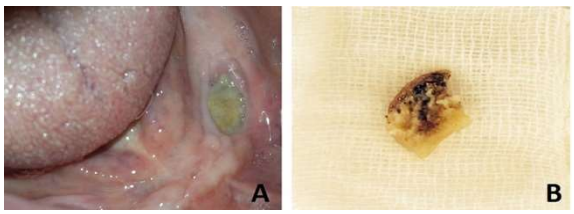

Figure 1- a) Clinic view of bone sequester b) Bone sequester

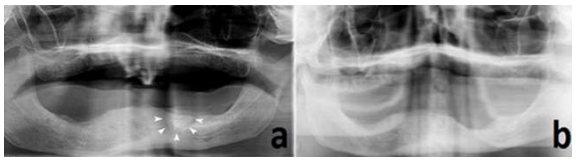

Figure 2- a) Preoperative radiographic image of the mandible b) Postoperative 3 months radiographic image

The patient was informed about the treatment and written consent taken from patient for the surgery. Local anaesthesia was applied (Lidocaine HCI 20 mg) to surgical area and mucoperiostal flap elevated carefully not to injure the nervous mentalis, exposed necrotic bone was removed by hand piece. Sharp minor irregularities in the bone and the bone portions have fixed by piezosurgery device (EMS piezon master surgery Nyon, Switzerland) and bone files. The procedure has been continued until reached in healthy and vascularised bone.

PRF PREPARATION

The PRF was prepared in accordance with the protocol developed by Choukroun et al.[10] just prior to surgery, 20 ml intravenous blood was collected in a sterile tube without anticoagulant immediately centrifuged in centrifugation machine (Hettich EBA 20 Buckinghamshire, England) at 2800 rpm for 12 min. The end blood product consists three layers following that: top most layers consisting of cellular platelet-poor plasma, PRF clot in the center, and red blood cells at the bottom. PRF was easily separated from red blood cell layer using a sterile scissors just after removal from the tube.Final product was applied to empty sequester area and flap was closed primarily with the 4.0 silk suture. After the operation, the patient was prescribed systemic antibiotics (Cefuroxime axetil 1gr twice a day, 14 days), non-steroidal anti-inflammatory drug (Ibuprofen twice a day, 5 days) and 0.12% Chlorhexidine rinse (twice a day for 2 weeks).

OZONE APPLICATION

The ozone gas was applied locally to the site of surgery, every day for one week after the operation. Ozone gas was applied approximately 1 mm distance from flap by a machine (W&H Prozone Bürmoos, Austria) and tips (Coro Tip). The application was performed according to manufacturer recommends following introduction; 18 second, with program 18 "protocol, total 2.5 min. (Figure 3).

Figure 3- Ozone application

There were no side effects and complications reported during the three months period. Completed healing of the

soft tissue that collapsed into the bone cavity was observed after 3 month follow-up of patient. (Figure 4) Bone graft procedure for reconstruction of bone defect area were suggested to patient after recovery phase but patient did not consent to surgery, thus patient was directed to prosthodontics.

Figure 4. Intraoral view of operation area after 3 months.

HISTOPATHOLOGY REPORT

According to histopathological analysis of bone sequester in decalcified bone sections, extensive abscess and purple dyed filamentous bacterial clusters and hemorrhages were observed in bone marrow. The diagnosis of patient was determined as osteomyelitis infected with actinomycosis.

DISCUSSION

Osteomyelitis, has variable clinical presentations with uncertain origin, and surgery is essential for treatment of chronic osteomyelitis but insufficient debridement causes recurrence of the disease probably.[17-19] Bone and soft tissue defects may require reconstruction after wide resections. In this case, we performed sequestrectomy and applied PRF and ozone for accelerating wound healing in patient with diabetes mellitus.

Multiple treatment models were investigated such as bisphosphonates, low-level laser therapy, and hyperbaric oxygen therapy (HBOT) for bone healing.[20-22] Chen et al.[23] performed HBOT for treatment of chronic osteomyelitis to 14 patient. There were no complications or recurrence 11 patients of 14. Handschel et al. [24] performed HBOT alone or combined with surgery to patients who had mandibular osteomyelitis. Recurrences developed some of these patients and retreated by HBOT. At the end of the study, authors suggested that HBOT useful option for osteomyelitis treatment. However, HBOT has a palliative effect. After two hours of hypoxia which in the ischemic region, continues and the therapeutic effects of hyperbaric oxygen decreases. On the other hand, ozone treatment, stimulates many biological mechanisms, thus therapeutic effects of oxygen continues in a few days.[25]

The ozone treatment is painless and increases the patients' tolerability and fulfillment with minimal adverse effects. Most of the published articles considering the use of ozone in dentistry have been in relation to its antimicrobial effects[26-28]. Also, there is insufficient evidence in the application of ozone in oral and maxillofacial surgery.[15] Ozone application to rat calvarial defects contributed new bone formation in some previous studies.[29, 30] Furthermore, increase in activity of growth factors which are extremely important for wound healing has been reported in chronic or acute wounds that exposed to ozone. The increase of angiogenesis, fibroblast activity and collagen synthesis have been reported.[31, 32]

PRF is an autologous preparation, utilizing the patient's own blood in a significantly small quantitiy. Also, PRF is

free from potential risks for patients, not difficult to obtain and use. Platelets within PRF contain many cytokines and growth factors that provide bone regeneration and soft tissue maturation.

Platelets have intensively platelet-derived growth factor, transforming growth factor β1 and vascular endothelial growth factor which are key growth factors. These growth factors have potential for matrix remodeling, cell proliferation and stimulating angiogenesis.[33] In recent two studies, authors used PRF for treatment intrabony defects and compared with open flap debridement. Groups which received PRF obtained significant pocket reduction and clinical attachment gain.[34, 35] Mazor et al.[36] stated that use of PRF as the sole filling material during a simultaneous sinus lift and implantation procedure had stabilized a good amount of regenerated bone in the sinus cavity up to the tip of implants in a case series through a radiological and histological evaluation at after 6 months from the surgery.

Diabetes mellitus and treatment methods of diabetes mellitus can lead many complications. Non enzymatic interaction of glucose with lysine and arginine amino acids in proteins causes intracellular and intercellular accumulation of irreversible advanced gylcation end products in diabetes mellitus. Tissue structure impairs by changing cellular functions as a result of accumulation of these products.[37] These changes include; inhibition of osteoclast differentiation, induction of osteoblast apoptosis and function, production defects of collagen which is main element of bone structure. All of these effects increase bone resorption by changing neoformation.[38] Vascular disorders which develop with diabetes can cause risk for osteomyelitis by affecting tissue blood supply had been mentioned in a review.[39] It's possible that bone exposure and osteomyelitis may occur due to irregularities in collagen and bone metabolism when considering diabetes mellitus of our patient.

CONCLUSION

Osteomyelitis is a destructive bone disease that is more difficult to treat and recurrence risk ratio is high. The combination of necrotic bone curettage, PRF and ozone application seem to be encouraging for the treatment of osteomyelitis, as it has proven successful outcomes with minimal invasivity. In literature, both of these applications have been proven in terms of releasing growth factors, promoting wound healing and bone maturation. These combinations may be useful for treatment options of osteomyelitis in diabetic patient

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