APPLICATION OF OZONE THERAPY IN THE TREATMENT OF LOCALIZED ALVEOLAR OSTEITIS

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By

MAGDY MOHAMED ZAKY HUSSAIN

(B.D.S/Mansoura University)

Department of Oral and Maxillofacial Surgery

Faculty of Oral and Dental Medicine

Cairo University

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Supervisors

Prof. Dr. Maha Mohamed Shawky

Professor of Oral and maxillofacial Surgery

Oral and Maxillofacial Surgery Department

Faculty of Oral and Dental Medicine

Cairo University

Prof. Dr. Mohamed Nabil Mawsouf

Professor of Pain Management

Head of Ozone Therapy Unit

National Cancer Institute

Cairo University

Abstract

Ozone therapy was proved to have antibacterial, antifungal, and virostatic activities. Also it has shown that ozone therapy promotes wound healing and relief pain associated with the inflammatory conditions. So, it was valuable to use ozone therapy in the treatment of AO in the current study to assess its healing, palliative, and antibacterial properties. This study included 40 patients, divided into two groups of 20 patients. In group (A) the socket irrigated with saline solution, and the patient instructed to use saline at home in between the follow up visits. In group (B) the socket irrigated with ozonated water then dried and filled with ozonated gel and the patient instructed to use the gel at home in between the follow up visits. The results reveal the antibacterial, palliative, and healing properties of ozone therapy.

Key words: Alveolar osteitis, Ozone therapy, saline.

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List of Abbreviations

Abbreviation	Term
AO	Alveolar Osteitis
OMFS residents	Oral and Maxillofacial Senior House Officers
SD Specialists	Specialists in Surgical Dentistry
PRP	Platelet rich plasma
TGF-β	Transforming growth factor beta
PDGF	Platelet derived growth factor
BIPP	Bismuth Iodoform SubnitritePaste
UV	Ultra Violet
IOA	International Ozone Association
ATP	Adenosine Triphosphate
ORI	O3 and its Reactive Intermediaries

ROS	Reactive Oxygen Species
P.C.R	Polymerase Chain Reaction
PBMC	Peripheral Blood Mononuclear Cells
VEGF	Vascular Endothelial Growth Factor
PRCLs	Primary Root Caries Lesions
χ^2 Test	Chi Square Test

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Introduction

Dry socket or Alveolar osteitis (AO) is one of the most common complications of tooth extraction and is characterized by severe pain starting usually on the second or third day postoperatively. Its prevalence has been reported to vary from 0% to more than 35% and is more common following mandibular third molar extraction. Patients experience pain and may experience loss of productivity. This makes the condition costly to both patient and society, as 45% of patients require multiple postoperative visits in the process of managing this painful condition [(1)].

Clinical presentation of (AO) demonstrates a partial or total disintegration of the intra-alveolar sanguine clot, resulting in a denuded bony crypt with surrounding debris. Suppuration is not evident but the patient usually complains of an acute throbbing pain emanating from the extraction site, frequently radiating to the ipsilateral ear and side of the

head. Pain resulting from (AO) is refractory to narcotic intervention and may be accompanied by abnormal taste and foul odor [2,3].

The condition is more common in the mandible than in the maxilla and in the posterior teeth compared to the anterior .There is no definitive cause for this condition but many precipitating factors have been implicated including frequent changing of pressure-dressing gauze, frequent mouth rinsing , underlying infection , smoking , oral contraceptive use , undue surgical trauma, and excessive amounts of local anaesthesia . In addition, the condition has been reported to occur more frequently in patients aged over 40 years [4]. Poor oral hygiene, gingivitis, periodontitis, and pericornitis have all been reported in to be associated with AO formation. Increased age and systemic conditions, such as diabetes and immunosuppression ,
have also been associated with a greater incidence of AO [2].

Several methods are reported to reduce the incidence of dry socket. These include the use of chlorohexidine mouth washes, the placement of medicated packing into the extraction sockets and the prophylactic use of metronidazole and lenampicillin [4].

Because of the proposed microbial origin, Prevention of alveolar osteitis has focused on systemic and topical antimicrobial therapies. Chlorhexidine, povidone iodine, 9-aminoacridine, metronidazole, tetracycline, and clindamycin in both systemic and localized regimens have been used as preventatives with varying degrees of success [5].

On the contrary, prescribing post operative antibiotic confers no benefit at all in AO and dressings that contain an obtundant for pain

relief and a non irritant antiseptic to inhibit bacterial growth may excite a host inflammatory or foreign body response. It was showed that the packs containing eugenol or other essential oils, zinc oxide and cotton wool relieve pain but eugenol devitalizes more bone and healing is delayed [6,7,8].However many methods are now being used for treatment of alveolar osteitis most of which are empirical and on no sound scientific basis.

One of the most remarkable discoveries in recent years in the field of alternative medicine is the use of ozone as a therapeutic agent. Ozone is a natural therapy involving the application of a mixture of oxygen and ozone with high efficiency, low cost and ease of application.

Ozone gas has a high oxidation potential and used as an antimicrobial agent against bacteria, viruses, fungi, and protozoa. It also has the capacity to stimulate blood circulation and the immune response. Such features justify the current interest in its application in medicine and dentistry and have been indicated for the treatment of different pathologies [9]. It can be used for the treatment of alveolitis as a replacement for antibiotic therapy, as a mouthwash for reducing the oral microflora, as well as the adherence of microorganisms to tooth surfaces. Ozone has been shown to stimulate remineralization of recent caries-affected teeth after a period of about six to eight weeks [9].

Ozone has been used in Medicine for many years. Research of its uses for infection control, and wound management is well established. However, recent research from many centers around the world, is exploring new applications and modalities of ozone in medicine.

Ozone gas seems totally effective in the management of dry sockets expressing its properties to revitalize the epithelial tissue, activation of local microcirculation, improvement of cellular metabolism of oxygen and the prevention of the requirement for systemic antibiotic treatment.

Review of Literature

Alveolar osteitis was first described by Crawford in 1896. The incidence of alveolar osteitis following routine extraction of erupted teeth has been reported as 1% to3 % [5].

Dry socket may be defined as the post-extraction sequela in which the blood clot either does not form or disintegrates after its organization leaving bare alveolar bone. The clot is replaced on the walls of the socket by grayish or yellowish green coloured layer. The condition is often characterized by severe neuralgic pain and foul odour[10].

Extraction of teeth is the most common procedure performed in oral surgery clinics. The most frequent reasons for extraction are dental caries and its sequelae, periodontal disease, trauma, retained roots, endodontic failure, and periapical pathology. In most cases healing of extraction sockets following routine intra-alveolar dental extraction are

uneventful. However, proper healing may be disturbed even in normal healthy patients for various reasons [11].

As a result that the socket is either empty or contains necrotic blood clot, sophisticated nomenclature of varied descriptions had been suggested over the past several years in hope of eliminating this unscientific term (dry socket). Unfortunately such terms were not successful, and dentists as well as oral surgeons continued to speak of dry socket as do contributors to dental literature. Among these terms are the following : dry alveolitis, alveolagia, painful socket, sloughing socket, necrotic socket, necrotic alveolar socket, localized osteomylitis, post-extraction osteomylitic syndrome, localized acute alveolar osteomylitis, postoperative osteitis, alveolar osteitis, localized osteitis, acute alveolar osteitis, alveolitis, osteitis post-extraction, avascular socket, epithelialized socket, circumscribed osteitic foci and post exodontic alveolar osteitis were mentioned. Finally the term fibrinolytic alveolitis was originated; however, the dry socket is still the most commonly used term for this condition [10].

Healing of Post-Extraction Wounds:

Following extraction, there is bleeding from exposed periodontal ligament vessels which cause the socket to fill with blood, the unsupported gingival collapses into the opening of the extraction wound, helping to maintain the clot in its position and reducing the size of the wound [12]. The clot prevents debris, food, and other irritants from entering the extraction site; protects the underlying bone; and acts as a supporting system in which granulation tissue develops [13].

Organization of the clot begins within the first 24 hours with leukocyte migration, capillary budding, and fibroblastic proliferation. The clot act as a scaffold on which cells associated with healing process may migrate. It is gradually replaced by granulation tissue. At the same time the epithelium grows from the mucosal edges over the surface of the organizing clot [12]. Small fragments of bone that have lost their blood supply are encapsulated by osteoclasts and eventually pushed to the surface or resorbed [13]. Osteoclasts accumulate along the crestal bone to set the stage for active crestal resumption. By the second week, the clot is highly organized with new capillaries extended to the center of the clot [12].

Epithelial proliferation over the surface of the wound may be complete around this time in case of small sockets. Trabeculae of osteoid tissue slowly start growing into the clot from the walls of the alveolus accompanied by concomitant remodeling of the cortical bone of the alveolar socket. This is evidenced on radiographs as a diminishing radio-opacity of the lamina dura, the socket is completely epithelialized and filled with osteoid tissue by the fourth week. However, osteoid tissue is being poorly calcified is not visible on the radiographs at this time [12].

Approximately one month after an extraction, coarse woven bone is laid down by osteoblasts. Trabecular bone then follows, until the normal pattern of the alveolus is restored. Finally, compact bone forms over the surface of the alveolus, and remodeling continues [13].

Occasionally the blood clot fails to form or may disintegrate, which causes a localized alveolar osteitis. In such instances, healing

proceeds slowly and the socket eventually fills with granulation tissue from the alveolar wall [12].

Wound healing is affected by several factors, these include local factors (growth factors, edema and ischemia, low oxygen tension, and infection), regional factors (arterial insufficiency, venous insufficiency, and neuropathy), systemic factors (inadequate perfusion and metabolic diseases), and other miscellaneous factors, such as nutritional state, pre-existing illness, exposure to radiation therapy, and smoking [12].

Necrosis at the wound margin may be due to impaired vascularity or infection which retards the process of healing. By phagocytic action, the dead tissue had been loosened and cast of as a slough. The study of aseptic necrosis had shown that by a completed alternation of apposition and resorption, the necrotic bone is gradually eliminated and replaced by vital bone [7].

Incidence of dry socket:

There is great variability in the reported incidence of post-extraction alveolar osteitis which may be due to differences in diagnostic criteria, intra-operative and post- operative treatment of the extraction sites, surgical techniques skill and differences in patient populations in various studies with respect to age, medical status and tooth positions [12].