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# Amalgamation of local antimicrobial & gelatin sponge therapy in the management of dead space of large pathological bony cavity in maxillofacial skeleton

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## Abstract

**Aim:** The present study was conducted to evaluate the efficacy of combination of gelatin sponge with local antimicrobials in the dead space management of large pathological bony cavity in the maxillofacial skeleton.

**Materials & Methods:** A prospective studied carried out in 10 patients who had to undergo surgical enucleation of pathological cavities. Thus, formed cavity formed was packed with antimicrobial loaded gelatin sponge. The wound was assessed based on the haemostasis achieved intraoperative and postoperatively, wound breakdown and presence of infection.

**Results:** The results showed wound healing was good in 90% of the cases. The wound breakdown was less, better haemostasis achieved due to the use of gelatin sponge

and absence of any pus drain due to the antimicrobial powder.

**Conclusion:** Antimicrobial loaded carrier in pathological cavity helps to reduce and eliminate dead space. Thereby preventing infection and better wound healing. The carrier and antimicrobial powder used is economical and easily available, hence it can be used widely. Being a preliminary case study, even though the results are encouraging, broader case study encompassing all the variables might be required for a final word on the said matter.

**Keywords:** Dead space, gelatin sponge, metronidazole, intrawound powder, abgel.

## Introduction

Dead space is defined as a space left in the body as a result of a surgical procedure. The term is commonly used to describe spaces resulting from the removal of a space-occupying mass or evacuation of fluid, tissue dissection resulting in disruption of tissue or facial planes, and tissue separation or disruption secondary to trauma (e.g., bite wounds, vehicular trauma, high-velocity projectile wounds). [1]

The depth and size of dead space can vary according to the extent of surgical resection of a mass and debridement of necrotic tissue.[2] Hematoma or seroma develop as a result of ineffective closure of cavity; this accumulation of excessive fluid separates tissue planes, which may contribute to infection in the presence of contaminants, hence causing delay in or prevent normal healing.[3] Thus, obliteration of dead space is crucial to prevent delayed wound healing and wound infection.

Clinical results suggest that the major factor for successful eradication of infection is surgical debridement and dead space management. Prevention of blood and tissue fluid accumulation in disrupted tissue area is the primary goal of dead space management. This can be achieved through surgical, non-surgical options or a combination of both. The most common techniques include placement of surgical drains, negative pressure wound therapy, water tight suture closure, compression bandage, hypodermic needle aspiration and local antimicrobials.

The present article describes the scientific evidence related to dead space management with a focus on the combination of gel foam and currently available local antimicrobial strategies in the management of large pathological bony defects.

## Materials and methods

### Study design

The prospective study was carried out in patients who reported to the Department of Oral and Maxillofacial Surgery, East Point College of Medical Sciences and Hospital, Bangalore. Sample size was determined to be 10 patients, who required surgical enucleation of odontogenic cyst and tumours. All patients were informed about the procedure and written consent taken. Routine haematological investigations were done. Clinical assessment and photographs were taken preoperative, intraoperative and postoperatively. Analysis of wound healing was done immediate postop, 24 hourly, 48 hourly, 3rd day, 1 week, 1 month, 3rd month and 6th month.

### Surgical procedure

The surgical site was prepared with standard aseptic precautions. Local anaesthesia (2% lignocaine with 1:80000 adrenaline) was locally infiltrated. Intraoral vestibular incision was placed. Mucoperiosteal flap raised, blunt dissection done. Bony cavity was prepared to expose the pathological lesion. Surgical enucleation was done and the cystic contents removed. Extensive debridement of bony cavity done. Copious irrigation done with betadine followed by saline. The pathological

cavity was filled with abgel and coated with antimicrobial powder (metronidazole). Closure done with vicryl 3-0. The routine postoperative instructions were given to all the patients. Cap. Amoxicillin 500 mg TDS, Tab. Metronidazole 400mg, Tab. Combi flam TDS and Tab. Pan D 40 mg BD for 5 days PO were prescribed for all the patients.

**Parameters**

**A) Wound healing score**

0: No wound breakdown.

1: Slight wound breakdown, explorable with blunt instrument.

2: Moderate wound breakdown, socket exposed.

3: Severe wound breakdown, socket exposed and nonvital bone visible.

**B) Presence of infection**

0: Absent

1: Present

C) **haemostatic action**

0: Good

1: Moderate

2: Poor

**Case series**

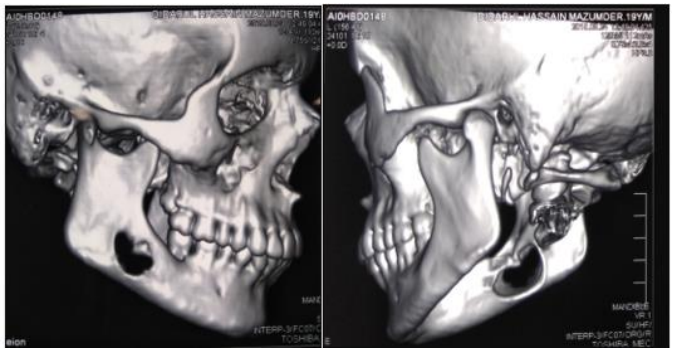
**Case 1**

A 20-year-old male patient came to our OPD with a complaint of slow growing swelling following the removal of his mandibular right 3rd molar, 1 year ago. On examination, it was a hard, bony swelling obliterating the buccal and lingual cortex. Associated with pain, no paraesthesia or pus discharge. Surgical enucleation was done under General Anaesthesia using Risdon's incision. The cavity was packed with abgel and intraoral antibiotic powder. The histopathology report results showed it to be AMELOBLASTOMA-PLEXIFORM VARIETY. The postoperative follow was done for 6 months. (Figure 1)

Fig 1(a) Preop OPG

B) Postop – 1 month

C) Postop – 6 months



D) Preop CT scan – lateral view (Buccal & lingual side of mandible)

E) Intraoperative: cyst exposed, excised cystic lesion, pathological cavity after enucleation

**Case** 2

A 45-year-old female patient complains of large, painful swelling with blood-tinged pus exudate in the right middle 3rd of face for 6 months. No paraesthesia, buccal vestibule obliterated and palatal mucosa intact.

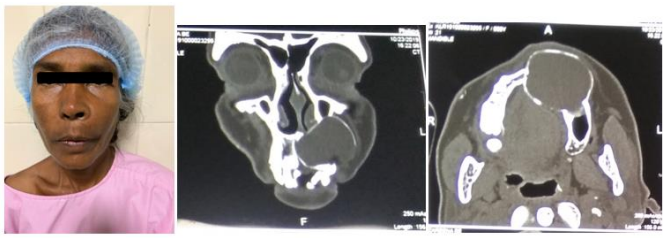
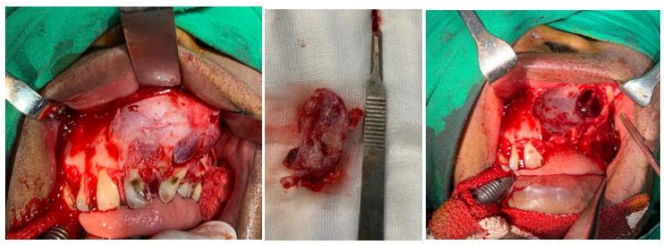


Figure 2 (A) Preop: CT coronal & axial view



(B) Intraoperative: Bony lesion exposed, Cyst excised, Pathological bony cavity

(C) Abgel loaded with metronidazole packed into cavity

(D) Closure

**Case** 3

A 19 yr. old male pt came to our OPD with a large painless bony hard swelling in the right middle 3rd of face for 1 year. Clinical examination revealed unerupted permanent canine, buccal vestibule obliterated, palatal mucosa intact, no sinus opening. FNAC was done, 20 ml of straw-coloured fluid was aspirated. PNS Xray showed permanent canine in close proximity to medical canthus of right eye. Vision and nasal breathing unaffected. Maxillary sinus involved, nasal septum intact. Surgical enucleation was cystic lesion was done in toto, permanent canine extracted, bony cavity was debrided thoroughly, irrigated and packed with gel foam coated with metronidazole, water tight closure done with vicyl 3-0. The biopsy reported dentigerous cyst.

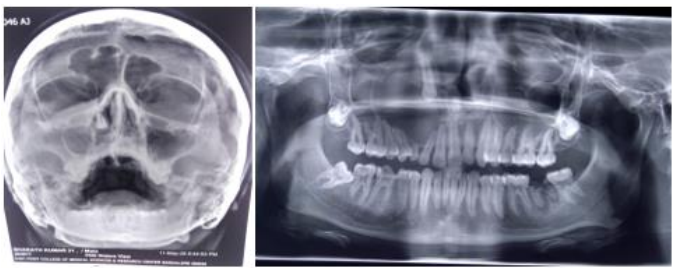


Fig 3 (A) Preop PNS X ray and OPG

(B) Post Op - Immediate

(C) Intraoperative – FNAC ( Straw coloured fluid), Pathological cavity, cyst enucleated with canine , closure

**Results**

**Gender distribution**

In our study, 70% of patients were males & 30% were females (Graph 1). Out of which 30% comprised of ameloblastoma, 40% dentigerous cyst and 30 % radicular cyst. (Graph 2)

**Assessment of wound healing**

**Wound Breakdown**

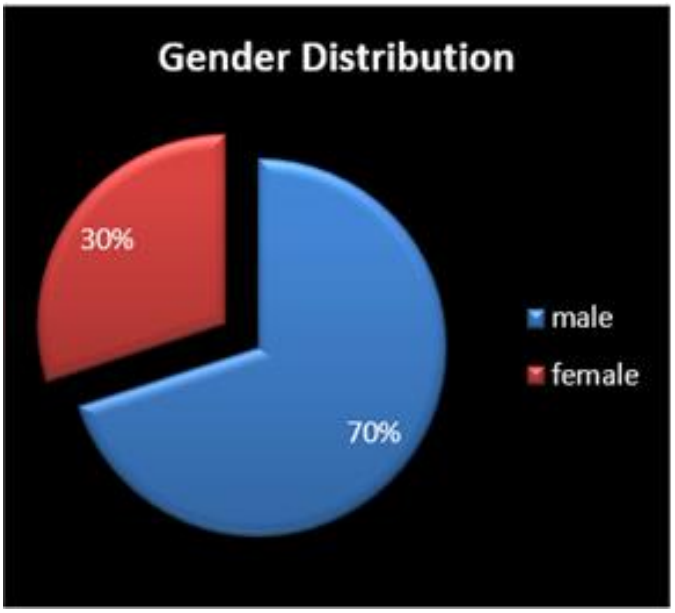
Postoperative wound healing was assessed, in the 24th hour, followed by the 3rd day and 7th day. Results showed that 9 patients (90 %) had no wound breakdown and 1 patient (10%) had mild breakdown on the first day. On the 3rd day only 3 patients (30 %) had mild breakdown of wound and 1 patient (10 %) had moderate breakdown. On the 7th day 8 patients (80%) had proper healing with no wound breakdown. Only 2 patients (20%) reported with mild breakdown. (Graph 3)

**Presence of Exudate**

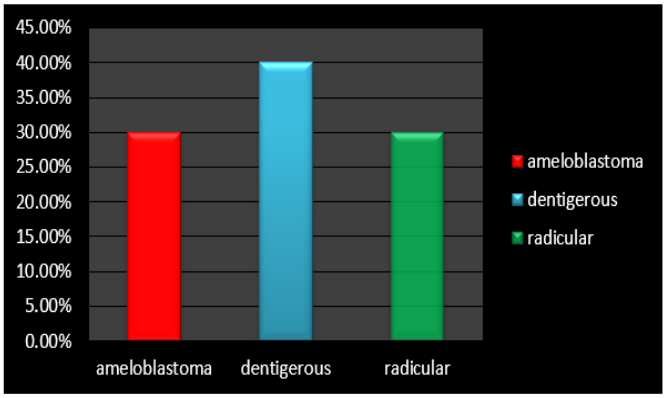
The surgical site was assessed for the presence of infection, pus drainage and necrotic tissue on 3rd and 7th day postoperatively. 20 % of the patients reported with infection on the 3rd day. There was complete reduction in infection on the 7th day postoperatively following management of the infection. (Graph 4)

**Hemostasis**

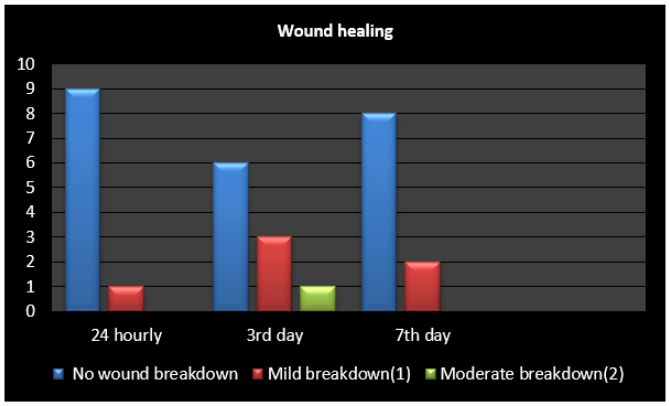
The assessment of surgical site showed good hemostasis in 80% of the patients postoperatively. Only 20 % of the patients showed moderate bleeding. No case of uncontrolled bleeding was noted. (graph 5)



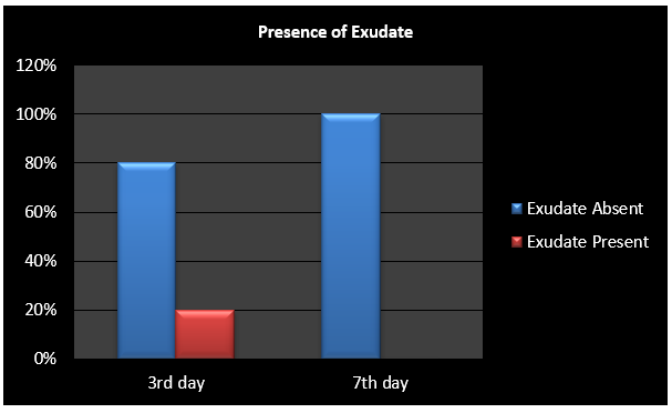

Graph 1: Gender Distribution



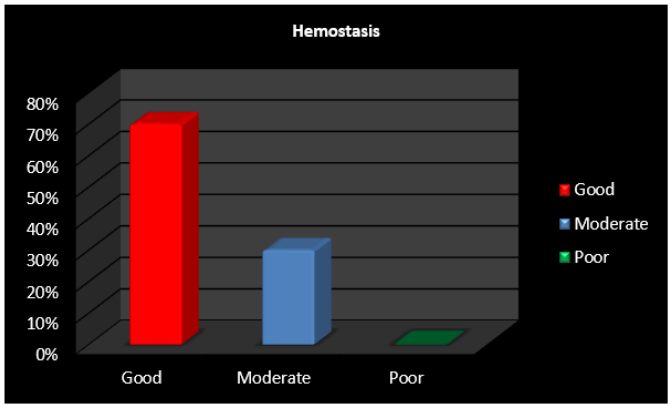

Graph 2: Type of Pathological Cyst




Graph 3: Wound healing




Graph 4: Presence of Exudate




Graph 5: Postop Hemostasis

**Discussion**

The basic principle for successful wound healing is elimination of dead space. If the surgical site is not properly filled, it leads to dead space.[5] Bacterial growth and fluid accumulation happens due to the presence of dead space, thus resulting in delayed healing and chronic wounds.

Wound healing is particularly challenging after large resection of tumours or enucleation of cyst leading to a large defect in maxillofacial hard and soft tissue. Therefore, wound closure and restoration of patient's function and appearance must be carried out by the maxillofacial surgeon at the earliest.

**Debridement, irrigation, and dead space management**

The most critical stage in the treatment of dead space is debridement which includes the excision of poorly vascularized bone/soft tissue, necrotic material and removal of foreign bodies.[6] This often creates a dead space, which is a poorly perfused defect allowing bacterial proliferation. Furthermore, the development of biofilm and bacterial persistence is enhanced due to the pH and low oxygen environment. To combat this, it is followed by irrigation with normal saline at low pressure to further decrease the bacterial load. [7-9] One of the temporary or definitive strategies for dead space management is the use of Local antimicrobial delivery systems.[10]

For maxillofacial surgeons and patients with complex wounds, decreasing the pain and shortening the treatment course are significant issues. In the past, physicians have treated these patients with debridement and dressing changes, which were painful and achieved slow healing. So, in our study we combined gelatin sponge (abgel) and intrawound antibiotic powder and packed the pathological bony cavity.

Abgel (Absorbable Gelatin Sponge)

It is a porous, off white, non-elastic, water-insoluble, pliable product prepared from purified pork-skin gelatin granules. Abgel is used as a physical haemostatic agent, does not interfere with the clotting mechanism and absorbed within 4- 6 week. It has been widely used in neurosurgeries, orthopaedic, otolaryngology, abdominal,

gynaecological, genital, urinary and anorectal surgeries to control bleeding. Similarly, it is also used in oral and maxillofacial surgeries. [11]

However, Abgel is contraindicated in the presence of infection, in closure of skin incision, intravascular compartments and as a primary treatment of coagulation disorders. It is available in a sterile enclosed envelope and should be stored at 25 C. It is available in the following sizes: Regular Size: 80 mm x 50 mm x 10 mm, Dental Size: 20 mm x 20 mm x 7 mm, Nasal Size: 80 mm x 15 mm x 7 mm. Fever, foreign body reaction, infection, toxic shock syndrome and giant cell granuloma are some of the risks associated with use of Abgel.

**Local antimicrobial therapy**

One of the main criteria in selection of an antimicrobial must provide be coverage against a wide range of pathogens (ie, broad-spectrum antibiotic) or against a specific pathogen identified by culture[12, 13]; it must have a good toxicity, low rate of resistance, hypersensitivity profile, compatible with and achieve an adequate release from the chosen carrier.

Even though the antibiotics are being locally administered, the risk of systemic toxicity should not be neglected.[14] The effect the antibiotic might have on the osteogenic activity and cell viability in the immediate vicinity must also be considered. .

Nitroimidazole derivatives are the choice of drug against clinically important anaerobes. Metronidazole-(2-hydroxycthyl)-2-methyl-5nitroimidazole, which is a nitro heterocyclic compound, has broad spectrum of activity against protozoa and anaerobic bacteria and specifically anti- anaerobic in nature .[15]

Metronidazole has been widely used in clinical dentistry as oral medicament, for endodontic regenerative procedure, intracanal medicament and obturating material. It is specifically anti-anaerobic in nature and known for its effective antibacterial activity against anaerobic cocci as well as Gram-negative and Gram-positive bacilli. It has been used both systemically and topically in the treatment of periodontal disease.

Chan et al[16] conducted to study the amount of infection elimination and bone incorporation achieved using antibiotic-impregnated cancellous bone grafting in patients with infected tibial nonunions. It proved that impregnated antibiotics have no adverse effects on autogenic cancellous bone graft incorporation. Different antibiotics (vancomycin, tobramycin, gentamicin) were used to target the infecting organisms that were found during the initial debridement (ie, first stage).It was also noted, recurrence rates were lower in the group that received local antibiotics.

In a clinical trial conducted by Kargul and co-workers[17], metronidazole was used as intra-canal medicament in pulpectomy in infected primary molars. The results showed reduction in the bacterial load 85% even after 24 months, where freshly mixed metronidazole cream was applied for one week as intra-canal medicament. Hence proving its effectiveness proves against endodontic bacteria which are mainly obligate anaerobes.

**Combination therapy**

In our study metronidazole was the antibiotic of choice which was delivered using abgel as the carrier. The study carried out showed good wound healing in most of the cases, no wound dehiscence, absence of infection and adequate haemostasis. Metronidazole was highly advantageous due to its ready availability, rapid bactericidal action, good tissue penetration and cost effectiveness. Acceptable pharmacokinetics and pharmacodynamics, undiminished antimicrobial activity and inability of susceptible organisms to develop

resistance makes it one of the best choices of drug as intrawound powder.

None of the patients developed any allergic reactions and the abgel was tolerated well by all the patients. Parental antibiotics were given over a period of 3 days after immediate postop. Adequate nutritional supplements were administered which enhanced the wound healing.

Serous transudate was noted as one of the early complications which was asymptomatic and resolved within 48 hours after surgery. No pus exudate or presence of infection was noted in any case, proving the effectiveness and action of metronidazole against bacterial growth.

Hence the combination therapy proved to be efficient and advantageous in the elimination of bacterial growth, better wound healing and management of dead space in large pathological bony cavities in the maxillofacial skeleton.

Since it was a preliminary case series, the sample size is less further studies on larger population will be able to assert the fact more strongly. Even local administration of antibiotics without carrier can be tried, eliminating the need for a specialized carrier and therefore, the cost is lower. However, an important drawback to this method is the fact that high local antibiotic levels cannot be sustained.

**Conclusion**

Combination therapy of gelatin sponge and antimicrobial does offer a good viable solution for bony pathological cavities. Since this is a preliminary case series, a broader study encompassing all the variables must be done to arrive at a definite protocol for dead space management of bony pathological cavity in Maxillofacial Skeleton.

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