

# Periapical Actinomycosis of the Mandible in Diabetic Patient: Comprehensive Case Report and Literature Review

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**Abstract:** Periapical actinomycosis is an uncommon infection that may lead to osteomyelitis, especially in immunocompromised individuals like those with uncontrolled diabetes mellitus. This case involves a 22-year-old male with type 1 diabetes who presented with recurrent dental abscesses, pain, and tooth mobility. Imaging revealed extensive periapical lesions in the anterior mandible. Biopsy identified *Actinomyces* spp., MRSA, and *Streptococcus viridans*. Due to severe bone destruction, the patient underwent full-mouth extractions, marginal mandibulectomy, and mandibular reconstruction using a microvascular iliac crest flap. A postoperative mandibular fracture necessitated further resection and reconstruction with a custom titanium plate. Vestibuloplasty with a split-thickness skin graft improved soft tissue adaptation, and two implants were placed in the parasymphysis region to support an overdenture. The aggressive infection, worsened by diabetes, required a multidisciplinary approach. The iliac crest flap offered structural support and enabled early prosthetic rehabilitation. This case highlights the need for early diagnosis and integrated treatment to achieve functional and aesthetic success.

**Citation:** Rocha CL, Alotaibi F, Kim D, Earnest L, Neeley E, Hyppolito JOP. Actinomicose Periapical da Mandíbula em Paciente Diabético: Relato de Caso Abrangente e Revisão da Literatura. Brazilian Journal of Case Reports. 2026 Jan-Dec;06(1):bjcr 129.

<https://doi.org/10.52600/2163-583X.bjcr.2026.6.1.bjcr129>

Received: 21 August 2025

Accepted: 4 November 2025

Published: 5 November 2025

**Keywords:** Periapical Actinomycosis; Mandibular Osteomyelitis; Type 1 Diabetes Mellitus; Microvascular Reconstruction; Iliac Crest Microvascular Flap; Dental Implants.



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## 1. Introduction

Actinomycosis is an uncommon chronic granulomatous infection caused by Gram-positive, non-acid-fast, branched filamentous, anaerobic, or microaerophilic/capnophilic bacillus bacteria of the *Actinomyces* genus. Due to their resemblance to both bacteria and fungi, *Actinomyces* are considered transitional microorganisms. *Actinomyces* spp. are normal commensals of the human oropharynx, gastrointestinal tract, and genitourinary tract [1]. Pathogenicity occurs when they invade necrotic or compromised tissue. *Actinomyces* are frequently isolated alongside other commensals, including *Aggregatibacter actinomycetemcomitans*, *Eikenella corrodens*, *Fusobacterium* spp., *Bacteroides* spp., *Capnocytophaga* spp., *Staphylococcus aureus*, *Streptococcus pneumoniae*, and *Enterobacteriaceae*, with microbial composition varying by infection site [2].

Periapical actinomycosis, a form of cervicofacial actinomycosis, manifests as persistent, recurrent draining fistulas in the periapical region. Although bone involvement is rare, osteomyelitis can occur as a secondary complication [3, 4]. Preoperative diagnosis is challenging, and most cases are identified postoperatively. Risk factors for *Actinomyces* infection include mucosal breach, impaired immune function, poor oral hygiene, facial trauma, prior head and neck radiation, or previous oral surgeries [1].

First-line treatment consists of prolonged high-dose penicillin G or amoxicillin, typically for 6 to 12 months. Alternative antibiotics for penicillin-allergic patients include tetracycline, erythromycin, doxycycline, and clindamycin. Surgical resection of infected tissue can shorten treatment duration [5]. This report presents a case of a 22-year-old patient with uncontrolled type 1 diabetes mellitus diagnosed with periapical actinomycosis and mandibular osteomyelitis who underwent complex mandibular reconstruction and dental rehabilitation.

## 2. Case Report

### 2.1 Initial presentation and diagnosis

A 22-year-old male patient with a medical history of uncontrolled type 1 diabetes mellitus and self-reported allergy to Amoxicillin and Clindamycin presented to the oral surgery clinic with a chief complaint of recurrent dental abscesses, severe pain, and tooth mobility. Clinical examination and imaging revealed extensive dental decay, multiple non-restorable teeth, and an expansile periapical lesion in the anterior mandible (Figure 1). The patient denied episodes of headache, cough with expectoration, respiratory distress, fatigue, or fever. Fine-needle aspiration yielded white keratinous debris. No lymphadenopathy was observed at the time of evaluation. To expedite diagnosis, a biopsy of the anterior mandible was obtained.

**Figure 1.** Panoramic and 3D imaging reveals patient's extensively decayed dentition with radiolucent osteolytic lesion on mandibular symphysis.



The biopsy pathology results revealed acute inflammation, bacterial organisms consistent with *Actinomyces* species, reactive bone, and fibroconnective tissue (Figures 2 and 3). Given the extent of dental decay, bone destruction, and Actinomycosis, the finalized treatment plan included full-mouth extraction, enucleation and curettage of the mandibular cyst, marginal mandibulectomy, nerve lateralization, and hardware application. Additionally, it was considered that the patient might require reconstructive bone surgery in the future, depending on the extent of surgical debridement.

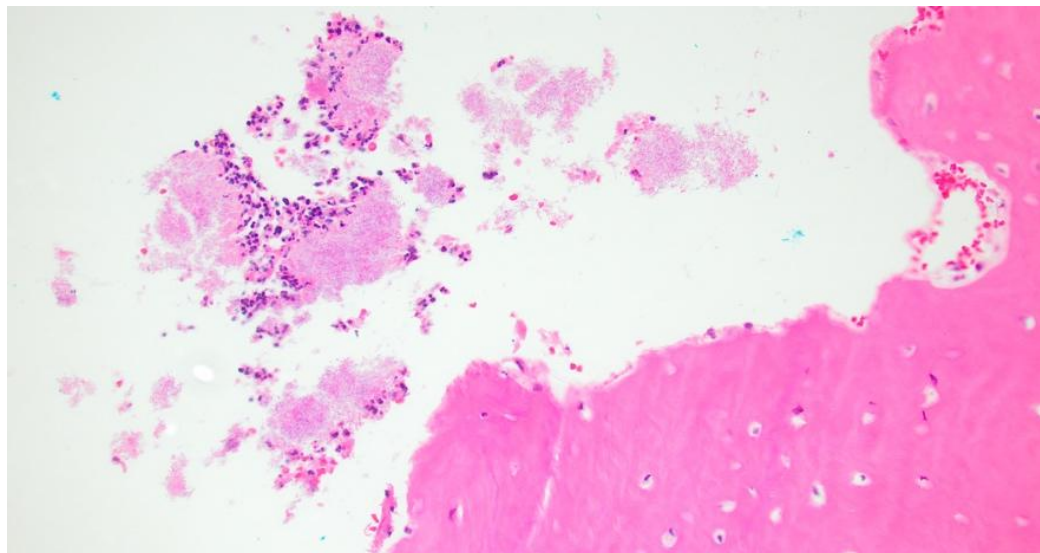
Other systemic evaluations were performed, revealing persistently abnormal glucose levels across multiple visits, ranging from 268 mg/dL to 518 mg/dL, and HcA1c > 14.0%. Considering patient's metabolic imbalance, diagnosis, antibiotics hypersensitivity, and oral health condition, the patient was put under care of multidisciplinary team including endocrinology, infectious diseases, oral and maxillofacial surgery, and general dentistry departments for comprehensive management.

### 2.2 Intraoperative findings and first-stage surgery (Ablative phase)

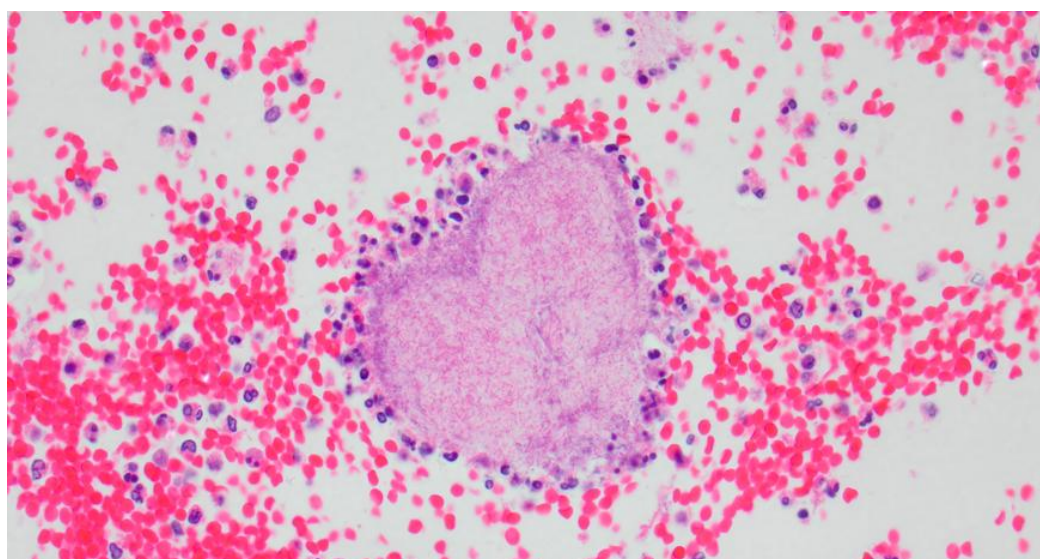
The first stage surgery included complete dental extraction and the Actinomycosis lesion in the anterior mandible was resected (Figure 4). Following thorough debridement of the infected bone, a fracture line was identified in the symphysis region. This finding modified the treatment plan from simple curettage to marginal mandibulectomy. Bone

reduction was carried out, and a 2.8 mm titanium reconstruction plate was contoured and secured to the symphysis using five 11 mm bicortical screws (Figure 5).

**Figure 2.** H&E 20x bone with bacteria and neutrophils: mandibular cyst lining with fragments of bone and aggregates of filamentous bacteria surrounded by neutrophils.



**Figure 3.** H&E 40x cyst contents with bacteria and neutrophils. Mandibular cyst fluid with aggregates of filamentous bacteria surrounded by neutrophils.



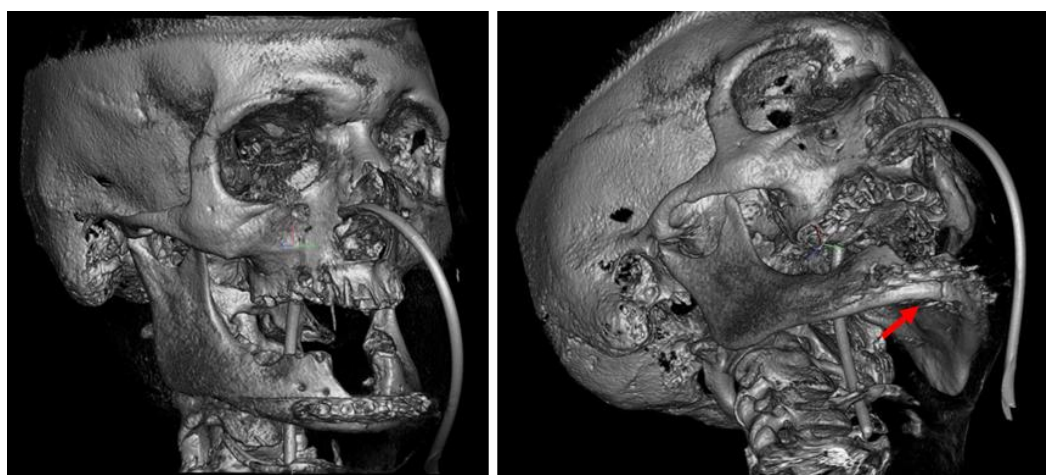
The resected lesion, bone fragments, and extracted teeth were submitted for further pathological and micro analysis, which subsequently identified the presence of *Actinomyces spp*, methicillin-resistant *Staphylococcus aureus* (MRSA) and *Streptococcus viridans*. This polymicrobial nature of the lesion had not yet been identified because a microbial culture was not performed with the initial biopsy.

The patient recovered postoperatively without major complaints, reporting only mild paresthesia of the inferior alveolar nerve. A follow-up computed tomography scan revealed suggestive findings of osteomyelitis. Given the poor bone quality of the remaining symphysis and the increased risk of reconstruction plate failure due to uncontrolled diabetes, a vascularized bone graft was planned for the next stage of reconstructive surgery. Patient was placed on the appropriate antibiotics by the infectious diseases team, and his diabetes was controlled with insulin pump.

**Figure 4.** Initial ablative surgery. Patient underwent full mouth extraction, excision of Actinomycotic lesion on symphysis for further pathological study, mandible debridement, and titanium reconstruction plate application to the mandibular anterior base.



**Figure 5.** Post operative 3D reconstruction highlights extraction sockets, debridement area, fracture reduction, and fixation hardware.



### 2.3 Second stage reconstruction (DCIA Flap)

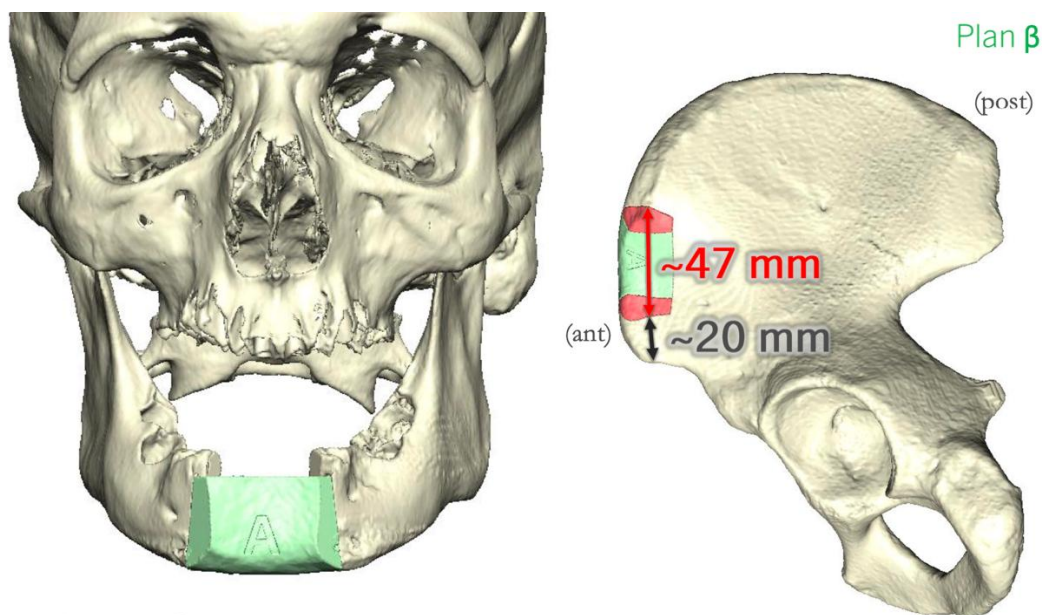
The interval between the first and second stages was six weeks to allow resolution of infection and stabilization of glycemic control. Considering the potential failure of the reconstruction plate and the poor bone quality, further compromised by diabetes and mixed infection, a second surgical stage was planned, including mandibular reconstruction with a Deep Circumflex Iliac Artery (DCIA) bone flap. The surgical site was debrided,

and the previously placed hardware was removed (Figure 6). The flap was designed with Virtual Surgical Planning (VSP) for accurate and precise reconstruction (Figure 7), and new custom hardware was positioned. The harvested flap was transferred to the head and neck region and appropriately oriented. The bony segment was secured to the custom plates using monocortical screws, demonstrating adequate stability (Figure 8). The internal oblique muscle was then draped over the bone and hardware. The left facial artery and facial vein were used for microvascular anastomosis.

**Figure 6.** Reconstructive surgery. Exposure and removal of initial hardware, segmental excision of osteomyelitic symphysis, specimen, and placement of custom reconstruction plate.



**Figure 7.** Virtual surgical planning of iliac crest flap.



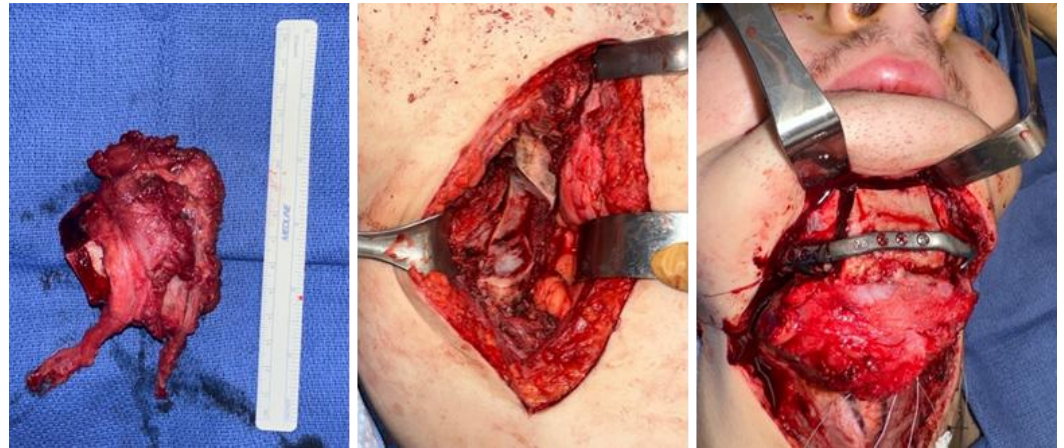
#### 2.4 Third stage rehabilitation (Vestibuloplasty, skin graft, and dental implants)

Following 4 months after an uncomplicated recovery from the second surgical intervention, the patient was referred to the general dentistry practice clinic for evaluation of dental rehabilitation. Post operative panoramic radiograph suggested good osteointegration conditions to proceed with dental treatment (Figure 9). Clinical examination revealed that the lower anterior vestibule was inadequate for proper denture fabrication due to insufficient depth.

Given the extensive loss of the mandibular ridge, the flattened anterior lower vestibule, and the patient's immediate and financial considerations, the third stage of his care included fabrication of a complete acrylic denture for the upper arch, pre-prosthetic lower

vestibuloplasty, placement of dental implants, fabrication of a traditional temporary complete acrylic denture for the lower arch, and subsequent conversion of this prosthesis into a removable implant-supported overdenture. Two implants were strategically placed in the anterior mandible, where bone quality and volume were optimal, to support a removable overdenture. This design allowed functional rehabilitation while minimizing biomechanical stress on the reconstructed graft (Figure 12 and 13).

**Figure 8.** Iliac crest microvascular flap, donor site, and flap successfully adapted, screwed, and sutured into custom plate and adjacent tissues.



**Figure 9.** Iliac crest microvascular flap, donor site, and flap successfully adapted, screwed, and sutured into custom plate and adjacent tissues.



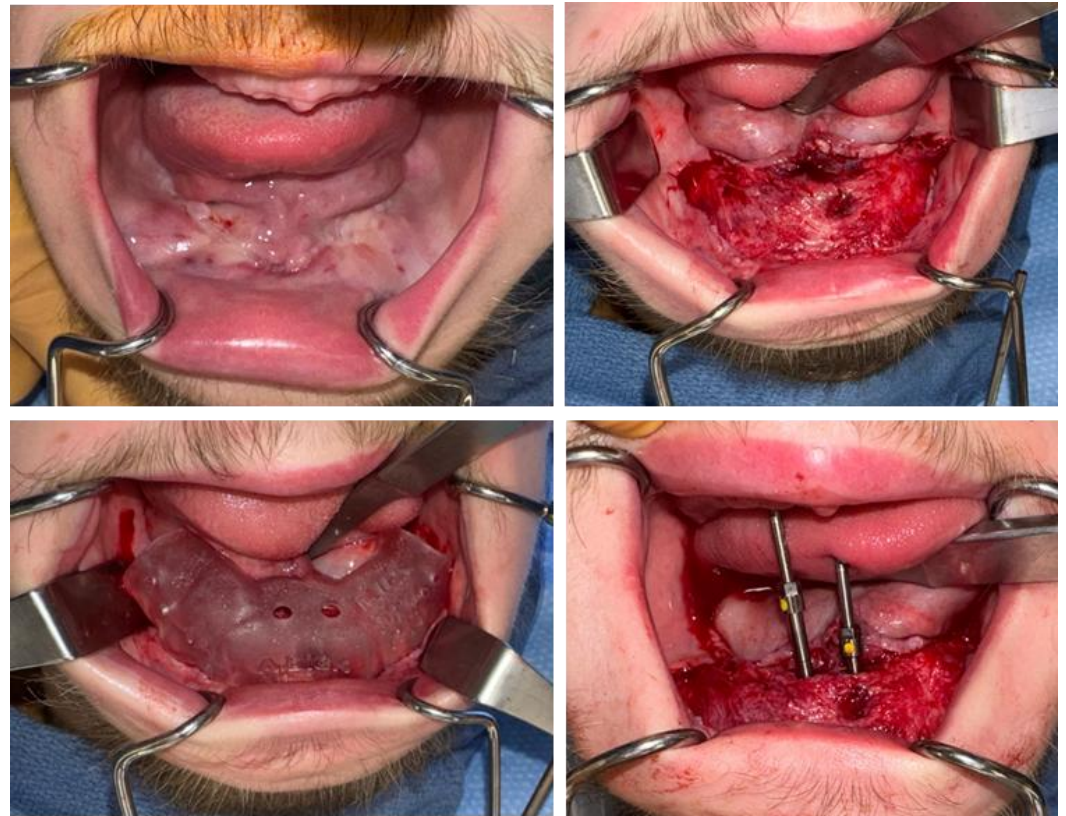
A split thickness skin graft and placement of  $4.3 \times 10$  mm implants at sites #22 and #27 were performed. Adequate vestibular depth was achieved, and the splint was positioned over the mandibular ridge and stabilized using four screws (Figure 10 and 11).

### 3. Discussion

*Actinomyces spp.* are commensal microorganisms of the human oropharynx, with a notable presence in dental plaques, gingival crevices, tonsillar crypts, periodontal pockets, and carious lesions. Actinomycosis is an infrequent yet potentially severe bacterial infection that can present in chronic, acute, or subacute forms, with an estimated annual incidence of approximately 0.00003% [6]. The cervicofacial variant is the most reported clinical manifestation, often referred to as “lumpy jaw syndrome,” and is frequently associated with extensive abscess formation and osteomyelitis. Epidemiological studies indicate a

male predominance, with reported ratios ranging from 1.5 to 3.1. Among its subtypes, periapical actinomycosis accounts for less than 5% of periapical lesions [7].

**Figure 10.** Shallow mandibular vestibule inadequate for dentures fabrications. Split thickness incision and vestibuloplasty performed, surgical guide for implants placement, and implants direction indicators in place.



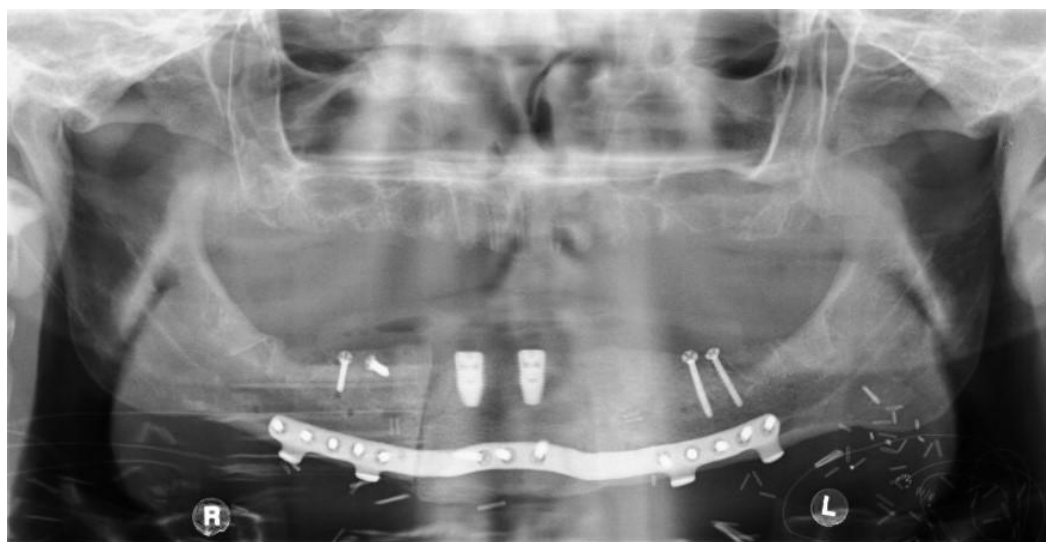
**Figure 11.** Skin graft removed from the thigh, sutures in place, and healing splint screwed into the mandibular ridge. The healing splint would be removed 2 weeks post op.



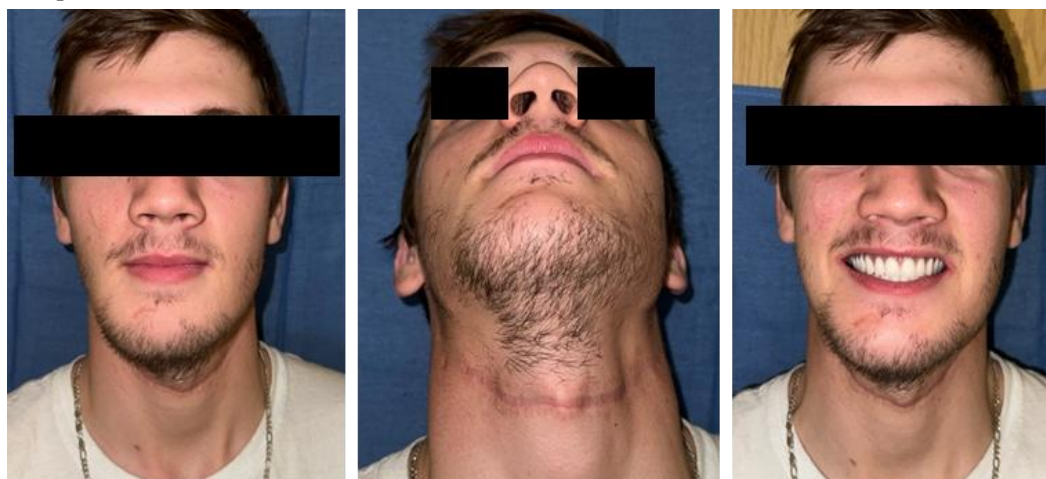
Chronic hyperglycemia, characteristic of poorly controlled diabetes mellitus, precipitates structural alterations in various tissues, impairs wound healing, and predisposes individuals to infections [8]. The present case involved a patient with type 1 diabetes mellitus and inadequate glycemic control, further compounded by insufficient oral hygiene. It is well-documented that elevated glucose concentrations in the wound fluid of

diabetic individuals facilitate bacterial proliferation, thereby exacerbating infection severity. The patient exhibited persistent hyperglycemia until hospitalization, where surgical interventions and dietary regulation led to improved metabolic control. Additionally, the patient's engagement in high-risk health behaviors, including tobacco use, alcohol consumption, and poor dietary habits, further contributed to disease progression.

**Figure 12.** Post Operative panoramic radiograph after vestibuloplasty, skin graft, and implants placement.



**Figure 13.** Final extra oral pictures. Neck scars show good healing and upper and lower complete dentures in occlusion.



The management of this infection was further complicated by the patient's documented allergies to both Amoxicillin and Clindamycin—first-line and alternative therapies for actinomycosis. The primary therapeutic approach for cervicofacial actinomycosis involves surgical intervention, comprising incision, drainage, and debridement, combined with prolonged antibiotic therapy [9]. Therefore, the situation called for the use of Daptomycin and Doxycycline under infectious disease supervision, emphasizing the challenge of treating polymicrobial osteomyelitis when common antibiotics are contraindicated. Based on cultures and sensitivities, the infectious disease team treated the patient with Daptomycin 8 mg/kg IV q24h and Doxycycline 100mg PO q12h for six weeks.

Given the extent of the lesion in the present case, a combined approach was adopted, involving mandibular debridement and antibiotic administration. However, extensive

bone loss resulted in mandibular fracture, necessitating a more aggressive surgical strategy, including segmental resection and subsequent mandibular reconstruction. Segmental defects of the mandible may arise from infectious processes, traumatic injuries, or neoplastic resections, leading to profound functional, aesthetic, and psychosocial consequences if left untreated. The decision regarding the optimal reconstructive modality depends on defect size, soft tissue availability, and overall patient condition. While plate reconstruction is a viable option when adequate soft tissue coverage is achievable [10], extensive defects often require autologous tissue transfer, particularly with the advent of microvascular surgical techniques [11, 12].

Although an initial reconstructive plate was placed, the poor bone quality, persistent infection, and systemic compromise led the team to conclude that definitive reconstruction with a vascularized flap would provide both biological stability and long-term resistance to reinfection. Free flaps have largely supplanted pedicled flaps for complex oromandibular reconstructions [13], with the vascularized iliac crest flap emerging as a preferred option due to its substantial bone volume, which can be contoured for optimal integration with the residual mandible. Additionally, this graft provides adequate vertical bone height and width, facilitating future prosthetic rehabilitation. In this case, the immediate placement of dental implants within the reconstructed bone was undertaken to support an overdenture prosthesis.

Vestibuloplasty, performed with or without a split-thickness skin graft, more commonly conducted during second-stage surgery or as an independent procedure to enhance soft tissue adaptation and optimize prosthetic retention. To ensure proper mucosal adherence to the reconstructed mandible, a custom-fabricated splint is recommended for postoperative stabilization. In the present case, excessive scar formation and vertical loss of both bone and soft tissue resulted in a shallow, inflexible vestibule. Without vestibuloplasty, lower denture retention would have been significantly compromised, particularly prior to implant osseointegration. Consequently, anterior implants were strategically placed to facilitate the fabrication of an overdenture, thereby addressing the anticipated retention challenges.

This case demonstrates that in severe polymicrobial osteomyelitis secondary to periapical actinomycosis, especially in the context of uncontrolled diabetes, successful outcomes depend on a multidisciplinary, staged approach integrating infectious disease management, microvascular reconstruction, and prosthetic rehabilitation. The sequence of interventions highlights the importance of timely surgical decision-making and individualized antibiotic protocols in immunocompromised patients.

#### 4. Conclusion

Periapical actinomycosis is an uncommon cervicofacial manifestation of actinomycosis, a chronic infectious disease caused by *Actinomyces spp.* Due to its nonspecific clinical and radiographic presentation, it is imperative that general dentists and dental specialists remain vigilant for signs and symptoms indicative of this condition. Furthermore, consideration of systemic factors that may compromise immune function and impair wound healing, such as uncontrolled diabetes mellitus, is essential in the diagnostic and therapeutic approach. Given the potential for misdiagnosis, the use of bacterial cultures and histopathological analysis is strongly recommended to ensure accurate identification of the pathogen and multidisciplinary approach are crucial for appropriate management.

Current evidence remains insufficient to establish a definitive treatment protocol for periapical actinomycosis. However, a combination of surgical resection of the lesion and prolonged antibiotic therapy has demonstrated clinical success in most reported cases. In the present case, the patient is currently at 10 months postoperatively, has been rehabilitated with complete removable dentures for both maxillary and mandibular arches, and is undergoing a four-month waiting period for implant osseointegration. Upon completion of this process, the general dentistry team will proceed with the fabrication of a mandibular overdenture to optimize function and stability.

Beyond its clinical complexity, this case contributes to the limited literature on periapical actinomycosis complicated by severe osteomyelitis in diabetic patients. Few previous reports have described such extensive polymicrobial osteomyelitis requiring a microvascular flap in a diabetic patient. It illustrates how tailored multidisciplinary management and the use of vascularized bone flaps can restore both function and aesthetics in otherwise high-risk cases.

**Funding:** None.

**Research Ethics Committee Approval:** The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published, and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

**Acknowledgments:** None.

**Conflicts of Interest:** All other authors declare no conflicts of interest.

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