

Case Report

Serratia marcescens Maxillary Sinusitis and Ethmoiditis in an HIV-Positive Patient Caused by Dental Implant Migrating into the Maxillary Sinus

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Abstract

Iatrogenic maxillary sinusitis accounts for a significant proportion of unilateral sinus infections. This report describes a 36-year-old HIV-positive patient with *Serratia marcescens* chronic left maxillary sinusitis and ethmoiditis caused by migration of a dental implant into the maxillary sinus. The implant was successfully removed endoscopically via functional endoscopic sinus surgery. Histopathological examination revealed polypoid mucosa with chronic inflammation, while microbiological culture grew *Serratia marcescens*, an uncommon and opportunistic pathogen. Targeted antibiotic therapy with trimethoprim/sulfamethoxazole was administered for 20 days. Six-month follow-up revealed complete remission without recurrence of sinusitis.

Keywords: maxillary sinusitis; dental implant; iatrogenic complications; endoscopic sinus surgery; *Serratia marcescens*; HIV

1. Introduction

Iatrogenic maxillary sinusitis (IMS) is one of the most common forms of paranasal sinus inflammation of non-nasal origin, accounting for approximately 30–50% of unilateral sinus infections [1–3]. The most frequent iatrogenic etiologies of maxillary sinusitis are the extrusion of endodontic filling materials and accidental displacement of dental roots into the sinus cavity during tooth extraction procedures [4,5]. The recent literature has highlighted growing concern over the rising incidence of dental implant migration into the maxillary sinus. Untreated displacement of implants into the sinus cavity may result in IMS [6,7]. IMS resulting from implant displacement into the maxillary sinus cavity is a distinct clinical entity characterized by chronic inflammation driven by oral anaerobic flora and biofilm formation. The implant acts as a foreign body, promoting bacterial adhesion and colonization typical of oral microflora. Most common bacterial pathogens causing chronic rhinosinusitis (CRS) are *Prevotella* spp., *Fusobacterium* spp., *Peptostreptococcus* spp., *Actinomyces* spp., *Streptococcus anginosus* group, *Staphylococcus aureus*, *Enterococcus faecalis*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa* [2,4,7]. Notable changes in the prevalence were observed during the COVID-19 pandemic, with increases in *Serratia marcescens* CRS post-pandemic [8].

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Serratia marcescens is a ubiquitous bacterium belonging to the order *Enterobacterales*, characterized by high genetic plasticity that enables it to adapt and persist in diverse environments, including soil, water, plants, and hospital settings [9]. In recent years, *S. marcescens* has gained attention as an emerging pathogen worldwide, associated with infections and outbreaks in immunocompromised individuals, particularly neonates and patients in intensive care units [10]. The clinical management of *S. marcescens* infections remains challenging due to its intrinsic resistance to several classes of antibiotics, including ampicillin, first- and second-generation cephalosporins, macrolides, and cationic antimicrobial peptides (CAPs) [11]. The high levels of antibiotic resistance observed across *Serratia* species result from the combined action of intrinsic, acquired, and adaptive resistance mechanisms [11].

The aim of this study was to present a case of implant-related maxillary sinusitis and ethmoiditis caused by the migration of a dental implant into the sinus cavity in an immunocompromised, HIV-positive patient, in whom *Serratia marcescens* infection was identified.

2. Case Report

A 36-year-old male was admitted to our department for endoscopic removal of a dental implant that had migrated into the maxillary sinus, accompanied by chronic left maxillary sinusitis and ethmoiditis, without the presence of an oroantral fistula. The patient had previously undergone bilateral dental implant placement in the maxilla without a sinus lift or augmentation procedure in May 2023, with a total of three implants inserted (one on the right side and two on the left). The two implants on the left side were lost spontaneously in February and July 2024, one of which migrated into the maxillary sinus. Since March 2024, the patient had experienced recurrent inflammatory swelling of the left cheek, pain, and purulent nasal discharge from the left nasal cavity. Pain intensity was rated at 2.5/10 on the Visual Analog Scale (VAS). Two courses of antibiotic therapy (amoxicillin and clindamycin) had proven ineffective, and the patient reported occasional use of nasal irrigation. Additionally, the patient had a history of syphilis treated two years earlier and HIV infection was diagnosed in 2016, and the patient was receiving antiretroviral therapy with Triumeq (50/600/300 mg once daily). At the time of evaluation, the patient exhibited low-level viremia, with an HIV RNA load of 67 copies/mL under ongoing antiretroviral treatment, consistent with adequate virological control. Immunological assessment revealed a CD3+/CD4+ T-cell percentage of 30% with an absolute count of 386.5 cells/ μ L, indicating a moderately reduced CD4+ population. The CD3+/CD8+ T-cell subset was elevated at 47.2%, with an absolute count of 766.1 cells/ μ L. The CD4/CD8 ratio was 1.1, which falls within the normal physiological range. The CD3+/CD4−/CD8− (double-negative) T-cell population accounted for 2.6%, and the CD3+/CD4+/CD8+ (double-positive) subset represented 0.2%, both within expected reference values. Overall, the results are consistent with a moderate decrease in CD4+ T-cell counts with preserved CD4/CD8 balance. He was a smoker (20 pack-years), consumed alcohol occasionally, and reported an allergy to pollen. Cone-beam computed tomography (CBCT) revealed a radiopaque structure consistent with a displaced dental implant in the left maxillary sinus, along with complete opacification of the left maxillary sinus, ethmoid air cells, and frontal recess due to mucosal thickening of granulomatous appearance (Figure 1).

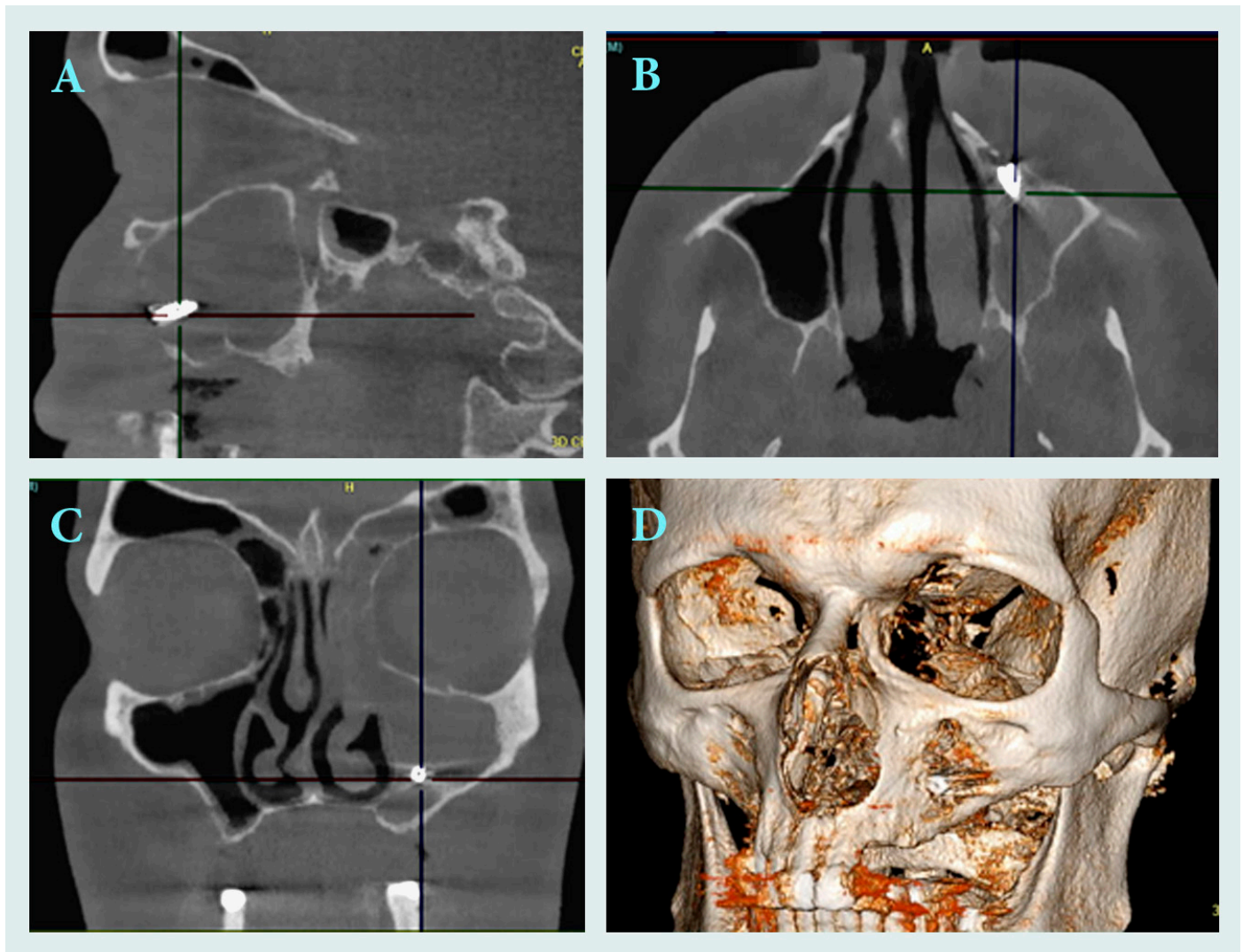


Figure 1. Preoperative CBCT showing the displaced dental implant and opacified left maxillary sinus, ethmoid cells, and frontal recess. (A) scan in the sagittal plane, (B) scan in the horizontal plane, (C) scan in the frontal plane, (D) 3D reconstruction.

2.1. Surgical Procedure

Surgery was performed in December 2024, under general anesthesia. Endoscopic sinus surgery (ESS) was conducted, including the left ethmoid, frontal recess, and maxillary sinus. The maxillary sinus was filled with purulent discharge, and the mucosa appeared edematous and granulomatous, which was removed and sent for histopathological and bacteriological evaluation. The dental implant was identified and removed (Figure 2). Spongostan (absorbable haemostatic gelatin sponge) was placed in the nasal cavity, and empirical antibiotic therapy Cefuroxime IV was administered perioperatively.

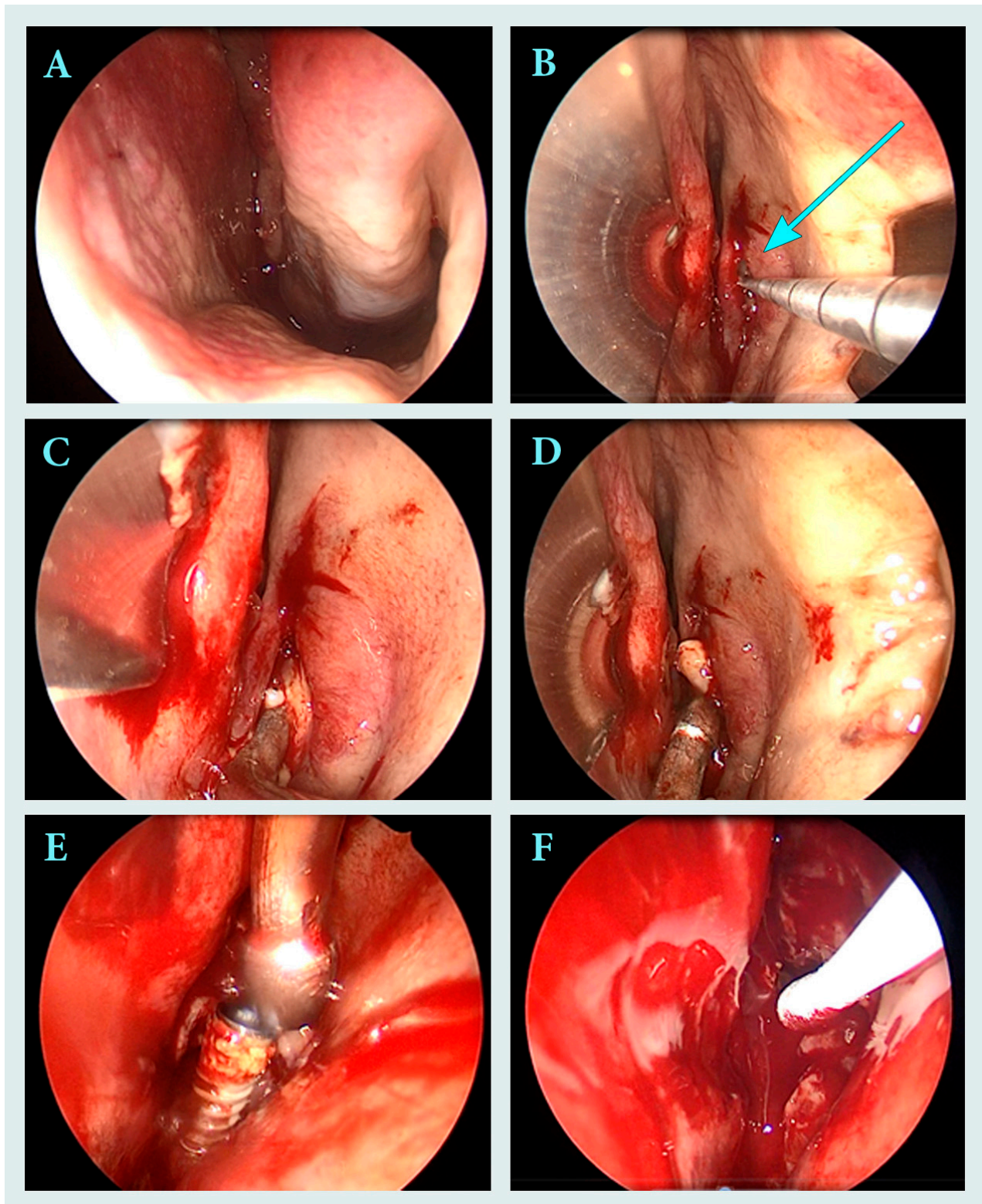


Figure 2. Intraoperative ESS stages: (A) endoscopic view of the nasal cavity, no visible purulent discharge; (B) incision of the bulging uncinated process of the ethmoid bone (arrow); (C,D) opening of the maxillary sinus; (E) removal of the implant; (F) collection for culture.

2.2. Follow-Up

Histopathological examination revealed fragments of polypoid respiratory mucosa with chronic inflammatory infiltration composed mainly of plasma cells and lymphocytes, with scattered eosinophils (up to 10/High-power field—HPF). Microbiological assessment

revealed *Serratia marcescens* (ESBL–) showing confluent growth, sensitive to piperacillin/tazobactam, cefepime, fluoroquinolones, and trimethoprim/sulfamethoxazole. Oral targeted antibiotic therapy with trimethoprim/sulfamethoxazole 960 mg twice daily for 20 days was administered. The patient was followed for the next six months. Follow-up CBCT and nasal investigation performed six months after the surgery demonstrated a patent maxillary ostium and complete resolution of inflammation (Figures 3 and 4). All clinical symptoms had subsided.

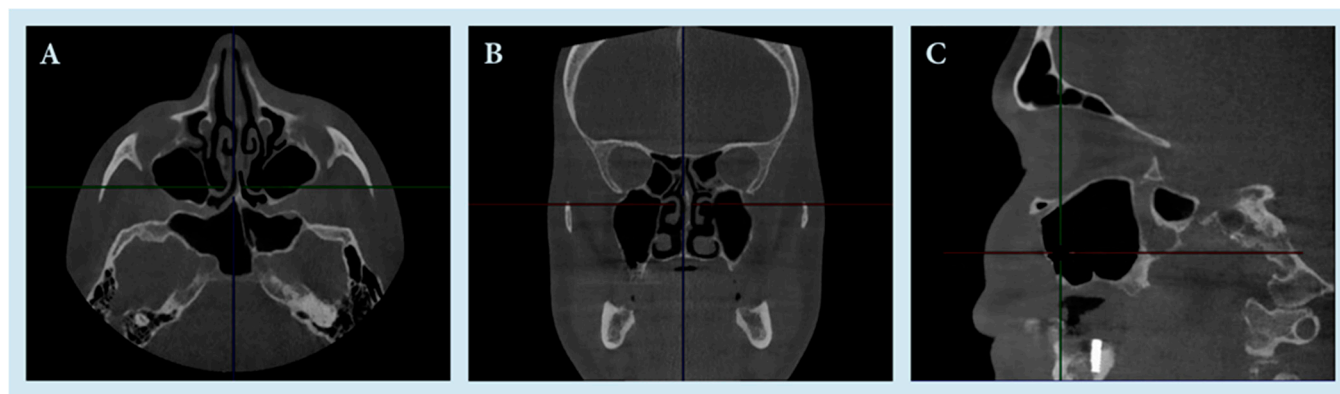


Figure 3. Postoperative CBCT showing complete resolution of sinusitis and ethmoiditis with patent maxillary ostium. (A) scan in the horizontal plane, (B) scan in the frontal plane, (C) scan in the sagittal plane.

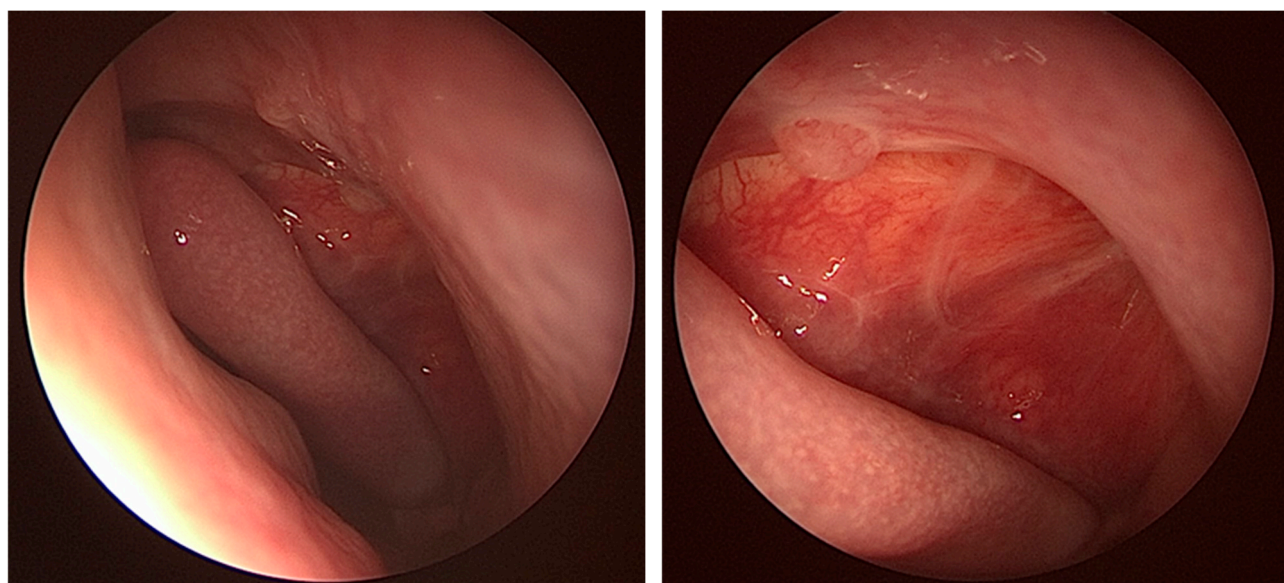


Figure 4. Endoscopic view showing a patent maxillary ostium without signs of inflammation.

3. Discussion

Iatrogenic infections of the paranasal sinuses following dental implant migration are clinically significant complications in oral and maxillofacial surgery. The introduction of a foreign body into the sinus cavity disrupts the mucociliary clearance system and promotes bacterial colonization, resulting in chronic maxillary sinusitis and, in some cases, secondary ethmoiditis. Odontogenic sinusitis is typically polymicrobial, with a predominance of anaerobic bacteria derived from the oral cavity. Common genera include *Fusobacterium*, *Prevotella*, *Porphyromonas*, and *Peptostreptococcus* organisms frequently found in periodontal and endodontic infections [12]. In the present report, the isolation of *Serratia*

marcescens, a Gram-negative, opportunistic pathogen, highlights the importance of microbiological diagnostics, particularly in immunocompromised patients such as those with HIV infection. *Serratia marcescens* belongs to the *Enterobacteriaceae* family and is known for its ability to survive in moist hospital environments, colonize medical devices, and form biofilms. Although uncommon in sinonasal infections, it has been increasingly reported in immunosuppressed individuals, including those with HIV, diabetes, or malignancies [13]. The bacterium demonstrates intrinsic resistance to several antibiotic classes, including ampicillin, first- and second-generation cephalosporins, and macrolides, due to chromosomal AmpC β -lactamase production [11,13,14]. Therefore, accurate culture-based susceptibility testing is important before initiating therapy. Antimicrobial resistance in *S. marcescens* represents a growing clinical concern. HIV infection predisposes patients to atypical and opportunistic infections through impaired mucosal immunity and macrophage dysfunction. Even in immunocompetent individuals, bacterial microcolonies may exist on the maxillary sinus ciliary epithelium [15]. In immunocompromised hosts, disruption of mucosal integrity, such as following implant migration, can allow these commensals to form pathogenic biofilms. Morawska-Kochman et al. [16] showed that bacterial biofilms and epithelial apoptosis are really important in CRS. They also found that there was increased expression of apoptosis-related markers, like caspase-3 and miR-21 [16]. These findings highlight the need for individualized treatment strategies that address both microbial and host factors.

The therapeutic approach to *S. marcescens* infections depends on disease severity, infection site, and the immune status of the patient. According to current IDSA and EUCAST recommendations, hospital-based regimens for moderate to severe infections include parenteral administration of cefepime (2 g IV every 8 h) or piperacillin/tazobactam (4.5 g IV every 6–8 h). For resistant or ESBL-producing strains, carbapenems such as meropenem (1 g IV every 8 h) are recommended. Alternative regimens for patients intolerant to β -lactams include fluoroquinolones, particularly ciprofloxacin (400 mg IV every 8 h, followed by 500–750 mg orally twice daily) [17,18]. In this case, due to the patient's refusal of hospitalization and parenteral administration of a targeted antibiotic, an oral regimen based on antibiogram results was implemented. Trimethoprim/sulfamethoxazole (960 mg PO twice daily for 20 days) was administered, leading to complete remission. Although fluoroquinolones are typically considered first-line outpatient agents, they were avoided to prevent adverse interactions with the patient's antiretroviral therapy (Triumeq: abacavir/dolutegravir/lamivudine).

The present case is an example that illustrates how the coexistence of smoking and HIV-related immunosuppression may have contributed to the development of a rare bacterial sinus infection by *Serratia marcescens*. Chronic tobacco smoking is known to impair mucociliary clearance in the nasal and sinus mucosa, a primary defense mechanism against inhaled pathogens, thereby facilitating bacterial colonization and infection. A classic study assessing mucociliary transit time demonstrated that smokers had significantly prolonged clearance compared with non-smokers [19,20]. Impaired mucociliary function may lead to the stagnation of mucus, reduced mechanical removal of bacteria, and thus increased susceptibility to sinusitis [21]. In a patient living with HIV, any additional compromise of mucosal and systemic immune defenses may further reduce resistance to opportunistic or unusual pathogens. Chronic HIV infection itself, even under antiretroviral therapy, can impair mucosal immunity and local barrier function, which may synergistically exacerbate the harmful impact of smoking on sinonasal defenses. In immunocompromised individuals, bacterial colonizers of the sinonasal cavities may more readily invade mucosa or sinus structures, leading to overt infection [22].

The main limitation of this study is that it presents a single case, as well as a relatively short follow-up period of six months in an immunocompromised patient, who may still

be at risk of sinusitis recurrence. This study highlights the importance of proper patient selection for implant treatment, particularly in patients with increased risk of implant failure due to peri-implantitis. According to the patient's history, no sinus lift or augmentation procedure was performed before implantation. However, we do not have access to the original surgical protocol or the planned implant-based dental rehabilitation, as the implant placement was carried out in a private dental clinic. For the same reason, we do not have documentation of the peri-implant status prior to implant migration, as well as details on implant type. The presented case also underscores the potential consequences of implant placement without a sinus lift procedure, which may lead to implant dislocation into the maxillary sinus. Close collaboration between the dental surgeon and the maxillofacial surgeon is essential in such cases. Following implant removal from the maxillary sinus and resolution of CRS, proper planning and qualification for implant-based prosthetic rehabilitation can be considered.

4. Conclusions

Optimal management of *S. marcescens* CRS in immunocompromised patients requires collaboration among the surgeon and infectious disease specialists. Early detection of implant migration, comprehensive microbiological assessment, and individualized therapy are essential for successful outcomes. Preventive measures during dental implant placement include preoperative CBCT evaluation, sinus lift procedure, careful drilling depth control, and immediate sealing of Schneiderian membrane perforations.

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Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

IMS	Iatrogenic maxillary sinusitis
CRS	Chronic rhinosinusitis
VAS	Visual Analog Scale
ESS	Endoscopic sinus surgery
CBCT	Cone-beam computed tomography
IDSA	Infectious Diseases Society of America
EUCAST	European Committee on Antimicrobial Susceptibility Testing

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