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# Late-onset Group B Streptococcus Periprosthetic Joint Infection Cured after Dental Clearance: A Case Report from Barbados and Literature Review

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## Abstract

Periprosthetic joint infection (PJI) is a devastating complication of total joint arthroplasty, with significant morbidity and economic burden [1,2]. Late-onset PJIs, occurring more than 24 months post-operatively, are often associated with hematogenous seeding from distant infection sites, with the oral cavity being a potential source [3,4]. This case report presents a rare instance of late-onset Group B Streptococcus (GBS) PJI in a patient from Barbados who underwent total knee replacement (TKR) surgery nine years prior. Despite multiple surgical debridement and prolonged antibiotic therapy, the infection persisted until the identification and treatment of an initially overlooked source severe periodontitis. This case underscores the role of oral health assessment in patients with unexplained PJI, and the role of dental clearance in successful treatment. A literature review of the association between periodontitis and PJIs is also presented.

**Keywords:** Periprosthetic Joint Infection, Group B Streptococcus; Revision Knee Replacement Surgery; Periodontal Disease; Periodontitis; Dental Clearance.

## Introduction

Periprosthetic joint infection (PJI) is a serious complication of total joint arthroplasty, occurring in 1-2% of cases [1,5]. PJI is associated with significant morbidity and healthcare costs [1,2]. Late-onset PJIs, presenting more than 24 months after the index surgery, are often hematogenous in origin, with the oral cavity being a potential source [3,4]. Periodontitis, a chronic inflammatory condition affecting the supporting structures of teeth, has been associated with systemic inflammation and an increased risk of PJI [6,7]. Streptococcal species are the second most common pathogens in PJIs, but Group B Streptococcus (GBS), though only accounting for 5-6% of these, being particularly virulent [4,8,9]. We present a case of late-onset GBS PJI associated with severe periodontal disease, successfully treated with revision knee surgery after dental clearance. The case highlights the importance of identifying and addressing potential sources of infection in the management of PJI.

### Case Presentation

A 73 year old, obese (BMI 34.1kgm-2) female self-referred to a private orthopaedic clinic with a painful, swollen and unstable left knee. She had a one-year history of these progressively worsening symptoms that was affecting her ability to mobilise without walking aids.

She had undergone uneventful left total knee replacement (TKR) surgery nine years prior and had no ill effects until one year prior, after she had spent one month in a private hospital where she was being treated for coronary artery disease. She underwent successful cardiac stent placement during that admission. Following discharge, her knee became painful and swollen. She denied any traumatic or systemic illnesses which may have accounted for the symptoms.

Her past medical history included hypertension, atrial fibrillation and coronary artery disease. On direct questioning, she denied suffering with diabetes mellitus, periodontal disease, autoimmune, malignant or immune deficiency conditions, and potential risk factors for periprosthetic joint infections (PJI)).

On examination, she walked with an antalgic gait and had a left Varus thrust. For the last three months, she reported, that she used a Zimmer frame to mobilize. Prior to that she walked unaided. There was a well healed midline knee surgical scar and no obvious stigmata of infection. On palpation, there was a grade 2 effusion, medial joint line tenderness, mild warmth, and significant Varus-valgus instability on direct testing. The range of motion (ROM) was limited to 10° to 87° flexion as measured with a manual goniometer. Her vital signs were all within normal range.

Based on the original history and clinical examination, a provisional diagnosis of TKR failure due to aseptic loosening was considered. Radiographs ordered at the time (Figure 1) confirmed tibial component loosening. Plans were made for an elective, single-stage revision total knee replacement (TKR) three months later, pending the results of routine pre-operative serological, cardiology and anaesthetic testing and pending her insurance company's approval.

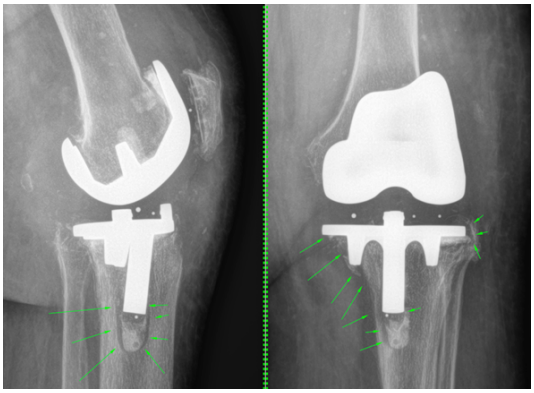


**Figure 1:** Lateral and Antero-Posterior Views of the Loose Left Total Knee Replacement. Arrows are highlighting areas of loosening around the tibial component

However, six weeks later, when the patient returned to the clinic for routine pre-operative MRSA screening swabs, she was noted to be septic. Her temperature was 38.1°Celsius, heart rate was 126 beats-per-minute (bpm), respiratory rate was 28 breaths-per-minute, and oxygen saturation on room air was 90% and her blood pressure was164/102bpm. Her left knee was now tensely swollen, and very hot to the touch. She had limited knee ROM with pain throughout the range. The neurovascular assessment was normal. The skin was intact and there was no evidence of sinuses or ulcers. Arthrocentesis was performed under aseptic conditions and more than 100ml of frank pus with mild blood staining was aspirated from the left knee (Figure 2). It was sent to the nearest laboratory for urgent Gram Staining, microscopy, culture, and sensitivity investigations.

**Figure 2:** Pus sample aspirated from the left knee.

Immediately, the definitive diagnosis was revised to septic loosening due to late onset PJI. The management priorities therefore changed. The priority was to surgically remove the infected prosthesis and the biofilm before the patient developed septic shock. The second priority was to accurately identify the pathogenic organism, and its origin, to help guide the therapeutic regime. The patient was therefore admitted to hospital and started empirically on Vancomycin intravenously because the Gram Stain of the aspirated pus revealed 45-50 WBC's/OIF and Gram-positive cocci, thereby confirming bacterial PJI. Blood investigations (Figure 4) were also suggestive of infection. The patient's first surgery (day 0) revealed infected medial subcutaneous soft tissues and a sinus tract leading to the biofilm covered medial proximal tibial bone and the loose tibial implant (Figure 3). All knee replacement implants were removed, biofilm debrided, and samples were sent for microbiology tests. A static antibiotic-impregnated cement spacer was fashioned with 160mg VersaBond™ AB with additional 4 grams of Vancomycin powder and implanted before closure and application of a hinged knee brace locked in extension.

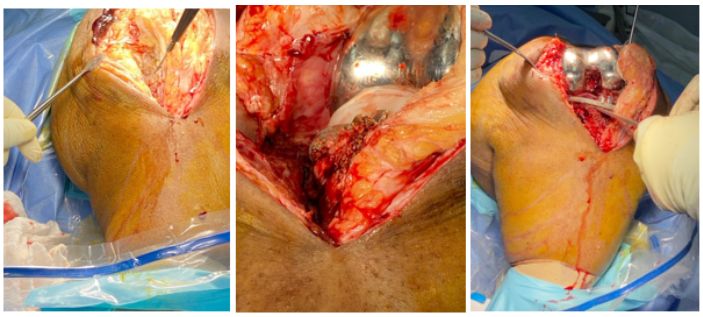
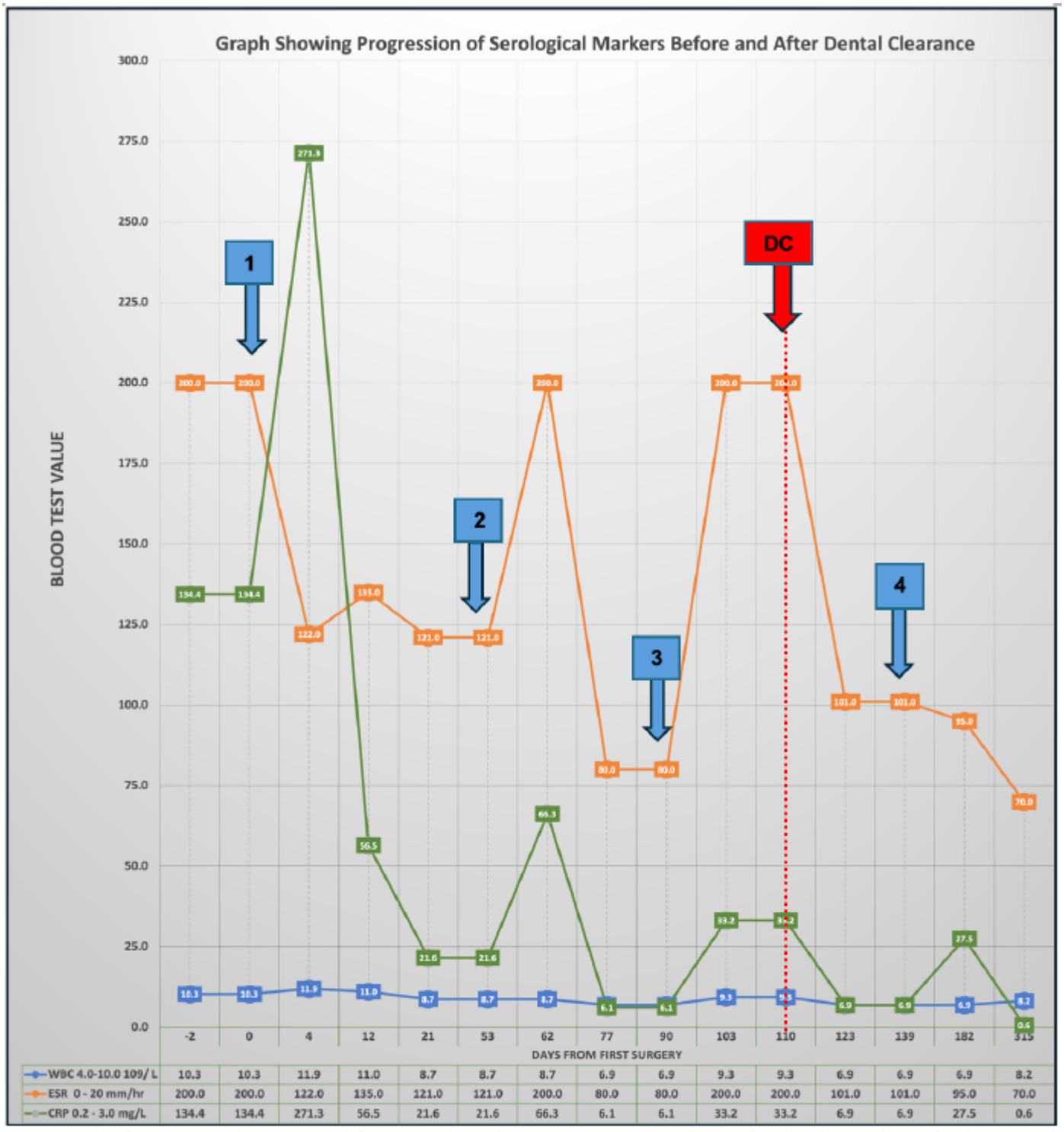


**Figure 3A, 3Band 3C:** Intraoperative images from 1st operation highlighting the infected tissue around the medial aspect of the tibial component

A peripherally inserted central catheter (PICC) was placed postoperatively and empiric antibiotics continued until culture and sensitivity results were received. Interestingly, Gram stain and cultures from the multiple tissue samples that were sent from the first surgery revealed no bacterial organisms. The culture result from the preoperative aspirate, however, grew Group B Streptococcus (GBS). Which was sensitive to Penicillin, Ampicillin and Erythromycin and resistant to Tetracycline. On day 5, the patient who was allergic to Penicillin, was discharged home with anticoagulation medications and Vancomycin 1g to be given twice daily for 7 weeks, along with fortnightly serological investigations and culminating in a second stage revision surgery using a condylar constrained device.

Unfortunately, there was a delay in detecting the source of the haematogenous PJI resulting in the patient, resulting in two further surgeries that included debridement, washout, and exchange of cement spacer operations before the definitive revision implant could be inserted in a fourth operation, 139 days after the first surgery. Because of the unavailability of Gram stain reagents in Barbados at the time, and the lack of resources to perform Fresh Frozen Section investigations, the second surgery (day 53) was performed to retrieve tissue samples for microbiological assessment. Fortunately, all these samples were devoid of pus cells and organisms, so plans were made for a third, and hopefully, definitive revision surgery as soon as the insurance company approved of such.

This third surgery occurred at day 90. At that stage, the patient had been off antibiotics for 2 weeks, serological markers of infection were declining (Figure 4), skin swabs, knee tissue and urine samples, as well as chest radiographs were clear of infection, and the echocardiogram revealed no evidence of endocarditis. No blood culture bottles were available in Barbados at the time, so these tests were not performed. However, when the cement spacer was removed intraoperatively, there was a new “biofilm” which looked suspicious and was sent for urgent Gram stain (reagent had become available). One hour later, the report of Gram-positive cocci was returned, so plans for implantation of knee replacement components were once again abandoned and a third debridement surgery performed. Vancomycin antibiotic was restarted and there was a renewed search for the infection source including, for the first time, a dental assessment and examination of the patient’s four residual native teeth.




| | -2 | 0 | 4 | 12 | 21 | 53 | 62 | 77 | 90 | 103 | 110 | 123 | 139 | 182 | 315 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WBC 4.0-10.0 109/L | 10.3 | 10.3 | 11.9 | 11.0 | 8.7 | 8.7 | 8.7 | 6.9 | 6.9 | 9.3 | 9.3 | 6.9 | 6.9 | 6.9 | 8.2 |
| ESR 0 - 20 mm/hr | 200.0 | 200.0 | 122.0 | 135.0 | 121.0 | 121.0 | 200.0 | 80.0 | 80.0 | 200.0 | 200.0 | 101.0 | 101.0 | 95.0 | 70.0 |
| CRP 0.2 - 3.0 mg/L | 134.4 | 134.4 | 271.3 | 56.5 | 21.6 | 21.6 | 66.3 | 6.1 | 6.1 | 33.2 | 33.2 | 6.9 | 6.9 | 27.5 | 0.6 |

***Figure 4:Graph and Data Table showing the progression of serological markers before and after dental clearance. Blue arrows represent timing of each of the four surgical interventions and the red arrow shows the timing of dental clearance (DC)***

On day 110, the patient consulted with a dentist who examined her four remaining teeth and reported that ALL the dental roots exhibited periodontal disease. The dental radiographs showed over 50% alveolar bone loss and loosening (Figure 5) and probing depths on examination were found to be >7mm, indicating the presence of severe periodontitis. The teeth were all deemed to be of poor prognosis and thus all four were extracted without complication.

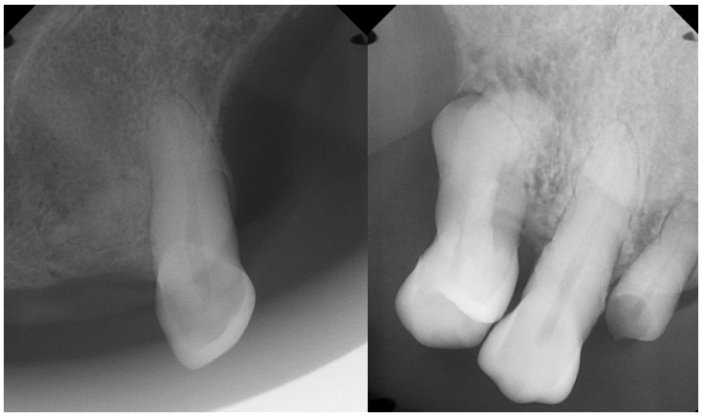


**Figure 5:** Radiographs showing severe periodontitis in the patient's four remaining dental roots.

Finally, on day 139, when all the pre-operative and intraoperative investigations were negative for infection, the patient successfully underwent implantation of a stemmed Zimmer NexGen® Legacy® Constrained Condylar Knee (LCCK) (Figure 6A and 6B). Apart from requiring a postoperative blood transfusion, she had an uneventful recovery period. She was walking with assistance of one person, a Zimmer Frame, and a hinged knee brace two days later. Tissue cultures from that surgery remained negative at 2 weeks postoperatively and her inflammatory markers (Figure 4) slowly returned to normal limits over the subsequent months.

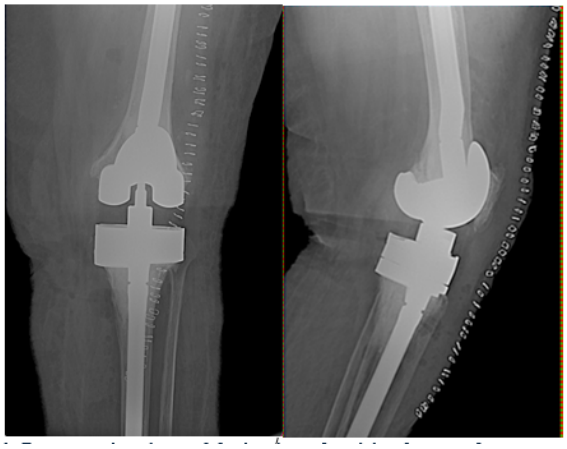


**Figure 6:** Postoperative views of the implanted revision knee replacement Zimmer NexGen® Legacy® Constrained Condylar Knee (LCCK).

The patient unfortunately defaulted from face-to-face follow-up after 10 months but has been available for telephone consultation. At 10-month follow-up, she was well, had no constitutional symptoms, a mouth full of new dentures and a "new" left knee that allowed her to mobilise independently with a walking frame for assistance. At 2-year telephone consultation she reported no changes in status.

## Discussion

Late-onset PJIs pose significant diagnostic and therapeutic challenges, often requiring a combination of surgical debridement, antibiotic therapy, and identification of the infection source [1,5]. In this case, the patient presented with a painful, swollen, and unstable left knee, nine years after TKR surgery. Initial diagnosis of aseptic loosening was revised to PJI following aspiration of frank pus from the knee joint. Multiple surgical debridement and prolonged antibiotic therapy failed to eradicate the infection until severe periodontitis was identified and treated with dental extractions.

Periodontitis, a chronic inflammatory condition affecting the supporting structures of teeth, is associated with systemic inflammation and an increased risk of PJI [6,7]. The oral cavity harbors a diverse microbiome, including potential pathogens that can enter the bloodstream during dental procedures or even daily activities such as brushing and flossing [9]. Streptococcal species, including GBS, are common oral pathogens and have been implicated in PJIs [4,8,9].

Several studies have reported cases of late-onset PJIs caused by oral streptococci, often in the setting of dental procedures or poor oral hygiene [12-14,17,18,21-23]. A systematic review by Moreira et al. found limited evidence to support the use of antibiotic prophylaxis in patients with periodontitis undergoing joint arthroplasty [6]. However, the authors acknowledged the potential role of periodontitis in the development of PJIs and emphasized the importance of oral health maintenance.

The diagnosis of PJI can be challenging, particularly in late-onset cases where symptoms may be subtle and inflammatory markers may be normal [8,24]. In this case, the initial diagnosis of aseptic loosening was revised following aspiration of frank pus from the knee joint. Multiple tissue samples were obtained during surgical debridement, with only the preoperative aspirate and intraoperative samples taken during the third surgery growing GBS. This highlights the importance of obtaining multiple samples for culture, as the sensitivity of a single sample may be low [5,8].

The treatment of PJI typically involves a combination of surgical debridement, antibiotic therapy, and exchange of the infected prosthesis [1,5]. In this case, despite prompt surgical debridement and appropriate antibiotic therapy, the patient's infection persisted, requiring multiple repeat debridement and prolonged antibiotic therapy. This is consistent with previous reports suggesting that streptococcal PJIs may be more difficult to eradicate than those caused by other pathogens [25-28]. The reasons for this are unclear but may relate to the ability of streptococci to form biofilms and evade host immune responses [9].

The key turning point in this case was the recognition of the patient's advanced periodontal disease as a potential source of the PJI. Periodontal disease is a chronic inflammatory condition affecting the supporting structures of the teeth, characterized by the formation of deep periodontal pockets and progressive alveolar bone loss [7]. These pockets harbor a diverse microbial community, including many species capable of causing PJI [9]. In a systematic review, Moreira et al. found a significant association between periodontal disease and PJI, with an odds ratio of 2.8 (95% CI 1.4-5.5) [6]. Following dental extractions, the index patient successfully underwent implantation of revision TKR components with no evidence of recurrent infection at 10-month follow-up.

The decision to proceed with complete dental clearance in this case was based on the poor prognosis of the patient's remaining dentition and the failure of previous surgical and medical interventions to eradicate the PJI. While the role of dental clearance in the management of PJI remains controversial, several case reports have described successful outcomes following this approach [12,21,22]. In a retrospective study of 36 patients with streptococcal PJI, Akgün et al. found that dental clearance was associated with a significantly lower failure rate compared to dental treatment alone (5.9% vs. 33.3%, p=0.02) [25]. From the scientific literature, the prognosis of streptococcal PJIs is variable, with some studies reporting high failure rates despite aggressive surgical and medical management [25-27]. While other studies report successful outcomes with appropriate treatment [28,29]. In this index case, the identification and treatment of the dental source of GBS infection was crucial to the successful eradication of the PJI to allow for definitive implantation of revision knee replacement components.

## Conclusions

This case highlights the importance of considering dental sources in late-onset PJIs and the role of dental clearance in successful treatment of such. Periodontitis, a chronic inflammatory condition affecting the supporting structures of teeth, is associated with systemic inflammation and therefore is a risk factor for PJI. Streptococcal species, including GBS, are common oral pathogens and have been implicated in PJIs. The diagnosis of PJI can be challenging, particularly in late-onset cases, therefore multiple tissue samples should be obtained for culture throughout the treatment period. The treatment of PJI typically involves a combination of surgical debridement, antibiotic therapy, and exchange of the infected prosthesis. However, the identification and treatment of the infection source, such as severe periodontitis, remains crucial to successful eradication of the infection. This case also illuminates the importance of a multidisciplinary approach in managing complex PJI cases. Orthopedic practitioners ought to collaborate closely with dental professionals to ensure comprehensive care, especially in patients with late-onset PJI where an oral origin is possible. Indeed, routine dental assessments should also be considered in patients with unexplained PJI as this could prevent prolonged morbidity and additional expense as in this index case. This approach not only aligns with contemporary understanding of the microbiology of PJI but also underscores the importance of a holistic view in orthopedic postoperative care. However, further research is needed to better understand the relationship between periodontitis and PJI and to develop evidence-based guidelines for the prevention and management of these infections [30,31].

## Disclosure

## Author Contributions

**Conceptualization and methodology:** T.N., E.G. and P.C; writing original draft preparation, T.N. and E.G.; writing review and editing, T.N., E.G and P.C supervision P.C.

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**Informed Consent Statement:** Written informed consent has been obtained from the patient(s) to publish this paper.

**Data Availability Statement:** Data supporting the study results can be provided followed by request sent to the corresponding author's e-mail.

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