May the jawbone healed from chronic sclerosing osteomyelitis be considered a healthy bone when planning to place dental implants? – Documentation of a case over 20 years

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Abstract

Background: Surgical extraction of mandibular third molars can result in frequent complications such as chronic sclerosing osteomyelitis (CSO), an inflammatory bone marrow condition that tends to progress. CSO involves the cortical plates and often periosteal tissues, and is caused by a broad spectrum of organisms, including Corynebacterium spp. Despite surgical and chemotherapeutic advancements, CSO of the jawbone remains difficult to treat.

Case presentation: We present the case of a 21-year-old Caucasian female who contracted chronic osteomyelitis (CO) and CSO after wisdom tooth surgery. A combination of alveolar ridge bone resection, extraction of teeth 47–32, and long-term specific antibiotic therapy against Corynebacterium spp. was performed. Attempting pre-prosthetic alveolar ridge reconstruction with a bone graft from the anterior superior iliac crest led to total graft failure, and the patient refused further harvesting procedures. Implantation in the intraforaminal zone also led to the loss of two implants immediately after loading. Finally, a nerve transposition procedure of the inferior alveolar nerve led to successful renewed insertion of the two implants used for prostodontic restoration and was still in full function almost 11 years later. The main purpose of this case report is to present the overall history of this unique case.

Conclusions: With a longitudinal observation period of over 20 years, the results of this case demonstrate the successful treatment of bone with CO, CSO, and Corynebacterium spp. infection. Due to the removal of the infected bone, radical debridement, and long-term administration of antibiotics, the bone recovered in a healthy condition.
Keywords: Chronic sclerosing osteomyelitis, Chronic osteomyelitis, Inferior alveolar nerve lateralization, Case report

Background

Surgical extraction of the mandibular third molars is one of the most commonly performed procedures in oral and maxillofacial surgery [1]. Surgery can result in frequent complications, such as trigeminal nerve injuries and alveolar osteomyelitis [2]. Osteomyelitis is a progressive bone marrow inflammation that involves the cortical plates and periosteal tissues [3]. Most cases occur as a result of trauma [4], bone surgery [5], vascular insufficiency [6], or tooth extraction in general [7] or are associated with dental implants in most cases [8].

Numerous classification systems have been proposed to categorize osteomyelitis, including suppurative or non-suppurative, hematogenous, or resulting from a contiguous focus of infection, and acute or chronic osteomyelitis (CO) [6]. CO can be classified into several subtypes, including suppurative CO [9], jaw osteonecrosis [10], bisphosphonate-related osteonecrosis of the jaw [11], and chronic sclerosing osteomyelitis (CSO) [12].

CSO was first described by Garre in 1893 [13] and is a condition that is not commonly reported. Although rarely reported, recent experiences indicate that CO and CSO are more common than previously thought [14,15]. Since mandibular CO has symptoms similar to other diseases such as osteonecrosis and chronic recurrent multifocal osteomyelitis, its true incidence is difficult to determine [14]. The clinical signs and symptoms of CO include local pain, fever, swelling, purulent discharge, intraoral and extraoral fistulas, unhealed soft tissue in the oral cavity, neuropalsy in the involved area, pathological fracture, and trismus [16]. The microbiological causes leading to mandibular osteomyelitis have a polymicrobial nature and involve a broad spectrum of organisms from the Streptococcus or Actinomyces genera, including Corynebacterium [14,15,17,18]. The precise pathophysiology of microbiological infections of the jaw is not fully understood; however, it has been suggested that inflammation occurs when typical microbial flora are disrupted [19]. Usually, this is a secondary process as the bacteria spread through adjacent soft tissues, extraction sites, or fracture sites to affect the bone [20]. Therefore, infections without soft tissue involvement are particularly rare [6].

Despite surgical and chemotherapeutic advancements, CO and CSO remain challenging. No universally accepted protocol for treatment exists [21,22]. Additionally, managing mandibular osteomyelitis may be challenging given its anatomic location and polymicrobial nature [23] and can lead to severe tooth and bone loss [6,23]. The alveolar bone resection and the resulting bone defects should be reconstructed since the presence of sufficient mandible bone is essential for successful dental rehabilitation [6,24]. If there has been a continuity resection of the mandible as a result of osteomyelitis of the jaw, several methods of reconstruction are available such as the fibula free flap (FFF) [25,26] or the deep circumflex iliac artery (DCIA) flap [26,27]. In general, the reconstructive goals for segmental defects of the mandible include achieving mandibular continuity, restoration of height and contour with an appropriate aesthetic, reconstruction of any soft tissue deficits, and restoration of mastication with adequate interincisal opening [28].

Successful long-term survival and success of dental implants depend on a sufficient amount and quality of bone [29]. For this reason, reconstruction of the alveolar ridge in combination with the placement of dental implants is crucial for achieving a sustainable functional outcome for prosthetic restorations in patients who have undergone alveolar bone resection for CO or CSO [30]. It is important for clinicians to clarify the method of choice in the connection between the success of dental implants and the mandibular bone after osteomyelitis occurs. Currently, several additive methods are available for reconstructing alveolar ridges. In additive methods, the height and width of the bony defect are reconstructed using an onlay of the augmentation material. These include bone block grafts [31], guided bone-regeneration techniques [32], and reconstruction using titanium meshes [33]. Although these are promising methods, only a few have been successfully used in patients with CO or CSO [34].

We would like to use this case report to demonstrate the successes and failures of several methods used to
rehabilitate the mandible after alveolar ridge/tooth extraction due to combined CO and CSO in a patient who had been followed for over 20 years. We present this case report in accordance with the CARE criteria [35].

Case presentation

We present the case of a 21-year-old Caucasian female, who had her right (48) and left lower third molars (38) removed in February 2003 by a board-certified oral and maxillofacial surgeon (Fig. 1, 7A). The patient’s genetic and psychological information was unremarkable. She was a smoker, but had an inconspicuous drug history. Regarding family history, it is worth noting that her grandmothers and cousins had diabetes. The patient’s father was diagnosed with laryngeal cancer and her uncle was diagnosed with blood and colon cancer. The patient underwent a 1-year orthodontic treatment (2003–2004) with fixed braces. After completion of the therapy, extraction of the third molars was indicated. For this reason, she went to a private surgical praxis in Vienna, Austria and started tooth extraction (48). During extraction under local anesthesia, no intraoperative peculiarities were observed. The postoperative course was uneventful, although there was inflammatory swelling on the right side. The inflammation was treated using local antibiotics.

Fourteen months after the procedure (May 2004), the patient returned with an inflammatory swelling on the right side and increased mobility of tooth 47 (Fig. 2A). The wound was cleaned by flaring and reaming, and the mobile tooth 47 was fixed to tooth 46 by wire ligation (Fig. 2B). Notably, the patient developed pneumonia at that time. Despite constant monitoring and local antibiotic administration, stabilization with a wire splint failed to improve the patient’s condition, and the lower right second molar was extracted in November 2004. Three months later, the lower right first molar was no longer worth preserving. The tooth was extracted, and the wound was excised.

Owing to the continuous progression of the inflammatory process, teeth 32–45 became successively mobile (Fig. 2C, 2D), and the patient was referred to Vienna General Hospital (June 2005). Computed tomography (CT), magnetic resonance imaging (MRI), and 3-phase scintigraphy were performed during the extended diagnostic workup.

Long-term antibiotic therapy oral with clindamizine (300 mg Dalacin; Pfizer, New York, NY) was initiated in August 2005. However, the progressive course of the disease resulted in the removal of teeth 33-45 during box resection in February 2006 (Fig. 7B, 3A). The teeth showed grade IV mobility. Mandibular box resection was performed, starting approximately from tooth 45, 1 mm above the exit of the mental nerve and extending widely to the opposite region 33. Box resection was performed approximately 3–4 mm below the chronically altered bone (Fig. 3B). The bone fragment with the overlying teeth 45-33 was removed and sent for histological examination. The edges were smoothed using a rose drill, and the bone was decorticated to reveal a well-perfused bone. The wound was sutured tightly, and the patient was given 600 mg clindamizine (Dalacin, Pfizer) intravenously and 500 mg prednisolone (Solu-Dacortin; Merck, Rahway, NJ).

As a domestic therapy suggestion, clindamizine (300 mg 3×2, Dalacin, Pfizer), thiamindisulfid (3×2, Neuribion forte; Procter & Gamble, Cincinnati, OH) and diclofenac (Voltaren; Novartis, Basel, Switzerland) were recommended for pain. The procedure was performed without complications; however, the infectious disease department suggested long-term continuation of antibiotics for 3 months. Histological examination of the biopsy specimen confirmed a tentative diagnosis of CO combined with CSO and no evidence of acute inflammation was found. Microbiological examination of the bone biopsy specimen showed increased growth of Corynebacterium spp. After an uncomplicated postoperative course, augmentation with an autologous iliac crest graft was performed in April 2007 to create an implant site (Fig. 7C).

A mucosal incision was made vertically over the remaining alveolar process in the median, and from there, a tunnelling preparation was performed to the left to tooth 33 and right (Fig. 4A, 4B). There, the mental nerve was exposed (Fig. 4C) and the preparation was continued, tunnelling to the retromolar trigonum. Simultaneously, the iliac crest was removed and the crista reached approximately 2 cm posterior to the anterior superior spina iliaca after layer-by-layer preparation. This was followed by careful subperiosteal dissection medially and laterally to an extent of approximately 8 cm and the removal of a monocortical
block of the inner corticalis with a saw. Finally, a second monocortical block was excised from the outer cortical bone. After smoothing the bone edges with a rose bur and applying bone wax to the cancellous bone, cancellous bone sponges were applied, a Redon drain was inserted, and layer-by-layer wound closure was performed.

The iliac crest bone was handed over and an L-shaped piece was adapted from the monocortical block, which could be supported from region 33 to the right jaw angle (Fig. 4D). This was placed in a previously prepared tunnel, and a recess was made in the area of the exit point of the mental nerve with the aid of a rose drill to avoid compression of the nerve. The bone piece was then fixed with two 16-mm synthesis screws (AXS; Stryker, Kalamazoo, MI) intraforaminally and Synthes screws at the right jaw angle. In region 33, a monocortical block measuring approximately 0.5 × 1 cm was inserted and fixed with a screw (Fig. 4E). Bone chips were inserted in the area of the retromolar trigone and the wound was closed tightly with Supramid® 4-0 (Braun, Kronberg, Germany) (Fig. 4F).

One month later (May 2007), dehiscence was observed in region 47, and the osseous margins of both the graft and the mandible were slightly more irregular, with a more obvious gap. The region was surrounded by marked inflammatory soft tissue enhancement and there was no evidence of osseous buildup.

Surgical recutting of the dehiscent site and visualization of the distal end of the iliac crest graft were performed. The synthetic screw in region 47 was removed, and the distal edge of the iliac crest graft was reduced using a rose drill. The wound was carefully curetted and irrigated with Betaisadona® (Mundipharma, Cambridge, UK).

At the same time, a smear was taken to determine resistance using the agar diffusion test. The result showed that the patient was resistant to clindamizine, erythromycin, and josamycin. After a complication-free postoperative course, the remaining screws were then exposed and removed on November 2007. Intraoperatively, the iliac crest graft was found to have little cancellous bone remaining but significant cortical bone.

In February 2009, CT of the facial skull was performed to check for osteomyelitis. There was no evidence of recent osteomyelitis.

In July 2009, the patient was followed up before implantation. CT of the mandible was performed. The bone was diffusely compacted in the mandibular region on the right side, with compaction extending to the midline and discretely extending beyond the left side. The bone contour was smooth and the cortical bone was intact. However, no recent osteolysis was observed. A markedly reduced height of the mandible on the right side (approximately 9 mm) was observed. In addition, MRI of the facial skull revealed no evidence of CSO. Because of this realization, four Ankylos (Dentsply Sirona, Charlotte, NC) implants were placed in the mandibular anterior region with Bio-Oss® (Geistlich, Wolhusen, Switzerland) under general anesthesia in October 2009 (Fig. 7D). This was followed by a gingival margin incision at regions 33–47. Mucoperiosteal flap preparation proved to be very difficult because of previous surgeries. The bones appeared clinically unremarkable. The nerves were visualized and spared. Implantation of four Ankylos (Dentsply Sirona) implants followed, with two implants in regions 41 and 42 (3.5 x 9 mm) and region 43 (3.5 x 8 mm), and one in region 44 (3.5 x 11 mm). All implants exhibited primary stability. Wound closure with 5.0 Prolene® (Johnson & Johnson, New Brunswick, NJ). The operation was performed without complications, and the patient was discharged with the therapy recommendations of amoxicillin/clavulanic acid (1 g Augmentin; GlaxoSmithKline, Brentford, UK) 2 x 1 and 400 mg dexibuprofen (Seractil; Gebro Pharma, Fieberbrunn, Austria; 3 x 1).

Five months later (March 2010), the implants were exposed under local anesthesia, the cover screws were removed, and the healing abutments were inserted. In June 2010, bone loss was observed in region 44 (Fig. 7E) and was treated with laser, antibiotic, and analgesic therapies. Amoxicillin/clavulanic acid (Augmentin, GlaxoSmithKline), dexibuprofen (Seractil, Gebro Pharma), and proton-pump inhibitors (pantoprazole) were recommended as medications. However, this did not prevent explantation; therefore, two distal implants in regions 43 and 44 were explanted (June 2010) (Fig. 7F). We planned to perform reimplantation in a more distal area. At the bone level, nerve lateralization was necessary before insertion.
In July 2010, the position of the inferior alveolar nerve (IAN) and adjacent anatomical structures was assessed radiographically, and the distance between the IAN and the alveolar ridge was measured at relevant points to perform the osteotomies. The surgical procedure was performed under local anesthesia using inferior alveolar, lingual, and buccal nerve blocking techniques. A linear incision on the crest of the alveolar ridge was made with a releasing incision anterior to the mental foramen, approximately in the mesial region of the canine, in such a way as to guarantee the coverage of the bone defect. A mucoperiosteal flap was then raised and the surgeon obtained direct visualization of the mental foramen, which was carefully released from the periosteum. To preserve the anatomic characteristics of the mental foramen area, circular marks were made around this structure only on the cortical bone with a spherical diamond bur using a low-speed handpiece. Subsequently, these markings were united and deepened with a piezo until the medullary bone tissue was observed, creating a ring around the mental nerve. Centripetal osteotomy was then performed, and the bone tissue was removed, leaving the nerve tissue free in the region of the foramen. Transection of the incisor nerve was then performed and lateral osteotomy was started from the buccal direction toward the trajectory of the IAN using a spherical diamond bur and a handpiece. A Nabers probe with a rhomboid tip was introduced into the mandibular canal adjacent to the buccal wall through the previously prepared mental foramen. This penetration was used to guide the lateral osteotomy and as a preparation for the spherical burr to minimize the possibility of lesions in the inferior alveolar vascular-nervous bundle.

IAN transposition was performed using a delicate spatula to manipulate the vascular-nervous bundle. A bone collector adapted to a surgical suction appliance was used during the osteotomy and bone cutting. After the two Ankylos implants (Dentsply Sirona) were placed in regions 45 and 46 (Fig. 7G), the bone tissue previously collected during the osteotomies and bone-cutting procedures was inserted adjacent to the implants, preventing the IAN from coming into contact with the implants.

A β-lactam antibiotic (500 mg amoxicillin; Ratiopharm, Ulm Germany) every 8 h for 7 days and an anti-inflammatory drug (500 mg mefenamic acid; Parkemed, Pfizer) were prescribed. Sensory alterations and radiographic findings were monitored periodically.

The surgical protocol for IAN transposition followed by implant placement presented excellent results, with complete recovery of sensitivity 7 months after the surgical procedure. Almost 2 years after the insertion of the implants, an implant bridge was prosthetically transferred from regions 33 to 46 with the special feature of a lingual prosthetic screw connection (October 2012). In February 2023, 11 years after handover of the prosthesis, the patient presented herself again at our university clinic (Fig. 7H and 5A). During this period, she only occasionally underwent professional teeth cleaning and dental checkups. The prosthetic restoration was removed with lingual screws to assess the clinical situation and to perform professional tooth cleaning (Fig. 5B, 5D). There were no radiological or clinical abnormalities. In addition, there were no mucosal changes or radiological evidence of detectable bone loss.

A digital periodontal examination was performed using the pa-on system (orangedental, Biberach an der Riss, Germany) and revealed an average pocket depth of 1.57 mm and recession of 0.00. Attachment loss was 1.57 mm and bleeding on probing was 69%. The maximum probing depth of 4 mm on the dental implants was only found in two places in the implant region: 47 lingual + implant regions and 32 vestibular regions. The risk assessment of the periodontal diagnosis of the patient was rated as high, because despite the history of a non-smoker and no systemic factors, bleeding on probing was found at 69%, there were two probing depths of [?]5 mm (tooth 15 buccal and tooth 28 buccal), the bone loss index was 0.49 mm, and there were 11 missing teeth (excluding wisdom teeth) (Fig. 6A, 6B).

The implants and remaining dentition were professionally cleaned sub- and supragingivally using Airflow® (EMS Dental, Nyon, Switzerland). The prosthetic fit was then reclothed and the patient was scheduled for regular recall appointments at short intervals (Fig. 5C). After this treatment, the patient was again reminded of the urgency of regular follow-ups, and we look forward to her presenting for follow-up within a few years.

**Discussion**

The aim of this case report was to demonstrate the efficacy and limitations of different methods of mandibular
rehabilitation after alveolar ridge and tooth extraction due to combined CO and CSO in a patient after
wisdom tooth surgery. A combination of alveolar ridge bone resection, tooth extraction from 47 to 32, and
long-term specific antibiotic therapy against Corynebacterium spp. was performed.

The question arises as to whether infected bone affected by Corynebacterium spp. infection and successfully
treated with antibiotics and surgical intervention can regenerate into healthy bone. In the present case, which
we have followed for over 20 years, we present the consequences of a complication after wisdom tooth surgery
in the form of a particular combination of CO and CSO, which resulted in the loss of nine teeth and the
alveolar ridge. Mandibular rehabilitation after alveolar ridge loss or tooth extraction in the form of an iliac
crest transplant, nerve laterализation, and implant insertion has never been described in the literature.

Osteomyelitis is more common in the mandible than in the maxilla because of the dense and poorly vascular-
ized cortical plates of the mandible and the vasculature originating from the inferior alveolar neurovascular
bundle [6].

Mandibular osteomyelitis was common prior to the discovery of antibiotics [6]. Host defenses, along with
systemic diseases, such as diabetes mellitus, autoimmune disorders, malignancy, malnutrition, and AIDS,
can contribute to the progression of osteomyelitis [36]. The patient had an unremarkable medical history,
although her immediate family members had diabetes mellitus.

Corynebacterium spp. are often present with other Gram-positive bacteria, such as Staphylococcus aureus,
Corynebacterium diphtheriae, or streptococci [37]. In vitro studies have shown that Arcanobacterium haemo-
lyticum, similar to Corynebacterium spp., is sensitive to most classes of antibiotics used to treat respiratory
tract infections, except for trimethoprim/sulfamethazine [38]. Higher penicillin concentrations may be requi-
red for tolerance.

Effective interprofessional communication among clinicians, clinical laboratory microbiologists, and pharma-
cists is crucial for managing patients with corynebacterial infections. Clinicians should communicate with
the laboratory to ensure proper handling of pharyngeal culture specimens when considering this diagnosis.
Consultations with infectious disease specialists may also be helpful [39].

To determine the best therapeutic approach, a close collaboration was conducted between the Clinical In-
stitute for Medical and Chemical Laboratory Diagnostics, Institute for Pathology, and the infectiologist.
The patient underwent long-term antibiotic therapy with 300 mg Dalacin (Pfizer) for 1.5 years to treat the
combined CO and CSO. Surgical debridement of the infected bone was performed, suggesting removal of the
infected site. In cases where the bone level is too low to accommodate sufficiently long implant attachments
without injuring the IAN, bone grafting is the recommended treatment for elevating the alveolar ridge and
facilitating implant placement.

Autologous bone is considered the gold standard graft for compromised bone, owing to its osteoconductive,
estoinductive, and osteogenic properties [40]. Additionally, autologous bone is histocompatible and non-
immunogenic. An iliac cancellous bone graft (ICBG) harvested from the anterior iliac crest is commonly used
because of its abundance, ease of harvesting, and simultaneous availability during alveolar cleft preparation
[41]. However, ICBGs have certain drawbacks, including significant donor site morbidity such as postoperative
pain, sensory disturbance, and claudication, leading to an extended hospital stay [42]. ICBGs are also subject
to unavoidable bone absorption, with reported absorption rates exceeding 40% after one year, potentially
necessitating reoperation [43]. In our case, failure of the iliac crest graft may be attributed to a success rate
lower than 40%, rather than to the quality of the bone.

Although osseointegrated dental implants have become reliable and effective for replacing missing teeth,
they are associated with clinical complications [44,45]. These complications can be categorized as biological,
technical, mechanical, aesthetic, or phonetic. These complications may compromise the outcomes of dental
implants to varying degrees [46]. Pathological lesions around dental implants are typically inflammatory and
result from bacterial accumulation on the implant surface, leading to an escalating inflammatory response
[47,48].
Peri-implantitis is the most commonly diagnosed pathological lesion around dental implants and is characterized by inflammation and local bone resorption [49,50]. Untreated infections can result in the accumulation of various odontogenic bacteria in the lesions, biofilm formation, and extensive bone resorption, ultimately leading to osteomyelitis [51]. Bacterial osteomyelitis of the mandible or maxilla has been reported in healthy patients following dental implant placement [52,53]. However, the relationship between bacterial osteomyelitis, peri-implantitis, and implant failure in the mandible or maxilla is not well understood, and there is no established treatment protocol for managing osteomyelitis and peri-implantitis in these cases [54].

Minimizing the incidence of biomechanical complications in single-implant restorations (SIRs) and partial fixed implant-supported prostheses (PFISPs) requires reducing the resistance to adverse leverage forces during function [55]. Placing implants as vertically as possible and ensuring shallow incisal guidance can help minimize adverse leverage forces on anterior SIRs and PFISPs [55].

Additionally, every 10-degree increase in implant inclination may lead to a 5% increase in the torque applied to the restoration during function. Biomechanically, the functional loads on implant restorations primarily affect the crestal bone surrounding the implant body [56]. Thus, caution must be exercised when multiple factors such as heavy occlusal forces, laterally positioned implants, and steep cuspal inclination are present, as they can concentrate stress at the abutment-implant connection, potentially leading to complications [55].

In our case, the loss of osseointegrated implants can be attributed to incorrect loading of the prosthetic restoration, as the distally inclined Ankylos implant (Dentsply Sirona) in region 44 could not be properly compensated because of the unavailability of appropriately angled intermediate parts. Consequently, unfavorable leverage forces were applied to the implant, resulting in its failure.

In addition to ICBGs, another option for rehabilitating edentulous atrophic posterior mandibles is IAN lateralization (IANL) or IAN transposition (IAT). These techniques, which have been used for more than 40 years, have shown good survival rates [57]. IAN repositioning was initially reported by Alling in 1977 for the rehabilitation of patients with severe atrophy who required dentures [58]. IANT offers advantages such as the ability to place longer fixtures and engages two cortices for initial stability [59]. Insufficient bone superior to the mental foramen is often a limitation for the ideal fixture length, and the existing superior bone is typically of poorer quality than the cortical bone. To overcome these challenges and reduce the failure rate associated with shorter implants, techniques have been developed to allow IAN repositioning and engagement of the inferior mandibular cortex for increased initial stability [60,61].

A major clinical concern with IANT is temporary or permanent nerve dysfunction, which leads to altered sensation in the lower lip and chin [59]. In our case, IANT allowed for the placement of a 10-mm Ankylos implant (Dentsply Sirona) without complications during both implantation and nerve transplantation.

Although the patient and practitioner were satisfied with the progress, even 11 years after prosthetic treatment, it is important to note that the patient carries a high periodontal risk and requires regular checkups at short intervals to ensure long-term success.

**Conclusion**

With a longitudinal observation period of over 20 years, this case demonstrates a favorable prognosis for implant rehabilitation in cases of combined CO and CSO infection with Corynebacterium spp. following successful treatment with the removal of infected bone, radical debridement, and long-term administration of antibiotics.

Clinical and radiological evaluations revealed no abnormalities that would not be expected in non-infected osteomyelitis-free bone. These results provide compelling evidence that following successful treatment with a combination of CO and CSO associated with Corynebacterium spp. infection, the affected bone can be regarded as being restored to a healthy state.

**Abbreviations**
CO: Chronic osteomyelitis; CSO: Chronic sclerosing osteomyelitis; CT: Computed tomography; IAN: Inferior alveolar nerve; IANL: Inferior alveolar nerve lateralization; IANT: Inferior alveolar nerve transposition; ICBG: Iliac cancellous bone graft; MRI: Magnetic resonance imaging; PFISP: Partial fixed implant-supported prosthesis; SIR: Single-implant restoration.

**Declarations**

**Ethics approval and consent to participate**

Not required by the relevant ethics committee.

**Consent for publication**

Written, informed consent was obtained from the patient for publication of this case report and accompanying images.

**Availability of data and material**

The datasets used or analyzed during the current study are available from the corresponding author upon reasonable request.

**Competing interests**

The authors declare that they have no competing interests.

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**Authors’ contributions**

All authors contributed to the conception and design of study; PG, BS, PB and FP-M contributed to data collection, analysis and discussion of data; DB contributed to the design of the graphics; DT contributed to the medical examination and medical treatment of the patient; All authors approved the version submitted for publication. All authors read and approved the final manuscript.

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We are grateful to the patient for her permission of the use of clinical data.

**Figure 1**

![Timeline of treatment over a period of more than 20 years](image)

Fig. 1 Timeline of treatment over a period of more than 20 years

**Figure 2**
Fig 2. OPT section of tooth 47 with inflammatory swelling on the right side and increased mobility (05/2004) (A). OPT section of tooth 47, that was fixed to tooth 46 by wire ligation (05/2004) (B). OPT section of 43-41 that became successively mobile (11/2004) (C). OPT section of teeth 43-32, that became successively mobile (11/2004) (D).

Figure 3
Fig. 3 Clinical Photo of the mandibular bone infected with CO and CSO in regio 45-32 (08/2005) (A). Clinical Photo after mandibular box resection was performed (08/2005) (B)

Figure 4
Fig. 4 Clinical situation before iliac crest graft (04/2007) (A). A mucosal incision was made vertically over the remaining alveolar process in the median (B). A tunnelling preparation was performed to the left and the inferior alveolar nerve shown (C). The iliac crest bone was handed over and an L-shaped piece was adapted (D). A monocortical block measuring approximately 0.5 x 1 cm was inserted and fixed with a screw (E). Bone chips were inserted in the area of the retromolar trigone and the wound was closed tightly (F).

Figure 5
Fig. 5 11 years after the handover of the prosthesis (02/2023) (A). The prosthetic restoration was now removed with its lingual screw prosthetic screws in order to assess the clinical situation and to be able to carry out a professional tooth cleaning (B). Lingual prosthesis screws (C). The prosthetic fitting was re-clothed (D)

Figure 6
A digital periodontal examination was performed (02/2023) (A). The risk assessment of the periodontal diagnosis of the patients was rated as high (B).

Figure 7
Fig. 7 OPT before surgical removal of tooth 38 and 48 (02/2003) (A). OPT after removal of teeth 33-45 in a box resection (02/2006) (B). OPT after augmentation with autologous iliac crest graft was to be performed to create an implant site (04/2007) (C). OPT after 4 dental implants were placed in the mandibular anterior region (10/2009) (D). Although the implants are without loading, bone loss appeared in OPT regio 44 (06/2010) (E). OPT after two dental implants in regio 43 and 44 were explanted (06/2010) (F). OPT after nerve lateralization of inferior alveolar nerve and insertion of implants in regio 45 and 46 were performed (07/2010) (G). OPT with radiological findings 13 years after the insertion of dental implants (02/2023) (H)

References


