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Case Report

A Case Report on the Management and Rehabilitation Following Implant-Related Compression of the Inferior Alveolar Nerve

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Abstract

Objective: This report aims to investigate the clinical manifestations, diagnostic methods, surgical management strategies, and subsequent rehabilitation options following inferior alveolar nerve (IAN) compression caused by improper implant placement.

Case Description: A 36-year-old male patient presented with persistent ipsilateral paresthesia (numbness, tingling) of the lower lip and chin region following implant placement in the mandibular posterior area at our hospital. Cone-beam computed tomography (CBCT) confirmed that the implant apex had perforated the mandibular canal and compressed the IAN neurovascular bundle. Surgical intervention involving removal of the compressing implant and concurrent IAN decompression was performed. Postoperatively, the patient's neurological symptoms gradually alleviated. Four months post-surgery, after initial healing of the bone defect, rehabilitation was achieved using a custom abutment and all-ceramic crown. Alternative prosthetic options (such as a fixed bridge) are also discussed.

Conclusion: Precise radiographic diagnosis is crucial for confirming nerve compression. Prompt surgical intervention, involving removal of the compressing agent and nerve decompression, is an effective approach for restoring neurological function. Following confirmation of nerve recovery and bone healing, functional and aesthetic rehabilitation of the affected site can be achieved through prudent prosthetic design. This case highlights the importance of precise preoperative assessment, meticulous surgical technique, and multidisciplinary collaboration in preventing and managing such complications.

Keywords

Dental implant, Inferior alveolar nerve, Nerve compression, Nerve decompression, Complications, Rehabilitation

1. Introduction

Oral implantology has become one of the preferred treatment modalities for the rehabilitation of partially and fully edentulous patients, with its high success rate and predictability being widely documented. However, implant surgery in the mandibular posterior region carries inherent risks due to its unique anatomical structure, particularly the presence of the inferior alveolar nerve (IAN). Direct compression or injury of the IAN by a dental implant is a serious intraoperative complication, occurring in approximately 1% to 5% of cases. This can lead to sensory dysfunction—manifesting as hypoesthesia, paresthesia, anesthesia, or pain—in the ipsilateral lower lip, chin skin, and gingiva, significantly impacting the patient's quality of life.

Once nerve compression occurs, immediate intervention is necessary. The management principles include the timely removal of the compressing agent (the implant), relief of nerve compression, creating a favorable environment for neural recovery, and, after stabilization of neurological function, re-evaluation and formulation of an appropriate prosthetic plan. This case report details the entire process of diagnosis, surgical management, and subsequent rehabilitation of a case involving IAN compression by a dental implant, aiming to provide a reference for clinicians in managing similar complications.

2. Methodology

This report is a retrospective case study. The subject was a 36-year-old male patient who presented to our hospital due to implant-induced compression of the inferior alveolar nerve. The study protocol was approved by the hospital's ethics committee, and prior to any procedures, written informed consent was obtained from the patient after he was fully informed of his condition, treatment options, potential risks, and alternative therapies.

3. Results

3.1. Surgical Findings and Immediate Postoperative Course

The surgical procedure was performed successfully without any intraoperative complications. Upon reflection of the full-thickness flap, the previously placed implant at the site of the mandibular first molar (#46) was fully exposed. After the careful removal of the implant, direct inspection of the mandibular canal revealed a clear defect in the buccal cortical plate and the roof of the canal. The inferior alveolar neurovascular bundle was visualized and appeared mildly compressed and edematous at the site of impingement, although its anatomical continuity was preserved. No active bleeding or significant fibrosis was noted. The implant was removed intact, and nerve decompression was

achieved. The patient tolerated the procedure well and was discharged on the same day with prescribed medications.

3.2. Radiographic Evaluation Post-Explantation

A postoperative panoramic radiograph or CBCT (if taken) confirmed the complete removal of the implant. The image revealed a well-defined bony defect at the previous implant site, corresponding to the osteotomy and the area of bone loss from the perforation. The continuity of the mandibular canal appeared restored after the decompression procedure.

Figure 1 shows that the implant is pressing on the alveolar nerve (**Figure 1**). **Figure 2** illustrates the nerve position after decompression, demonstrating good recovery of the neurovascular space (**Figure 2**)

Figure 1

Shows that the implant is pressing on the alveolar nerve

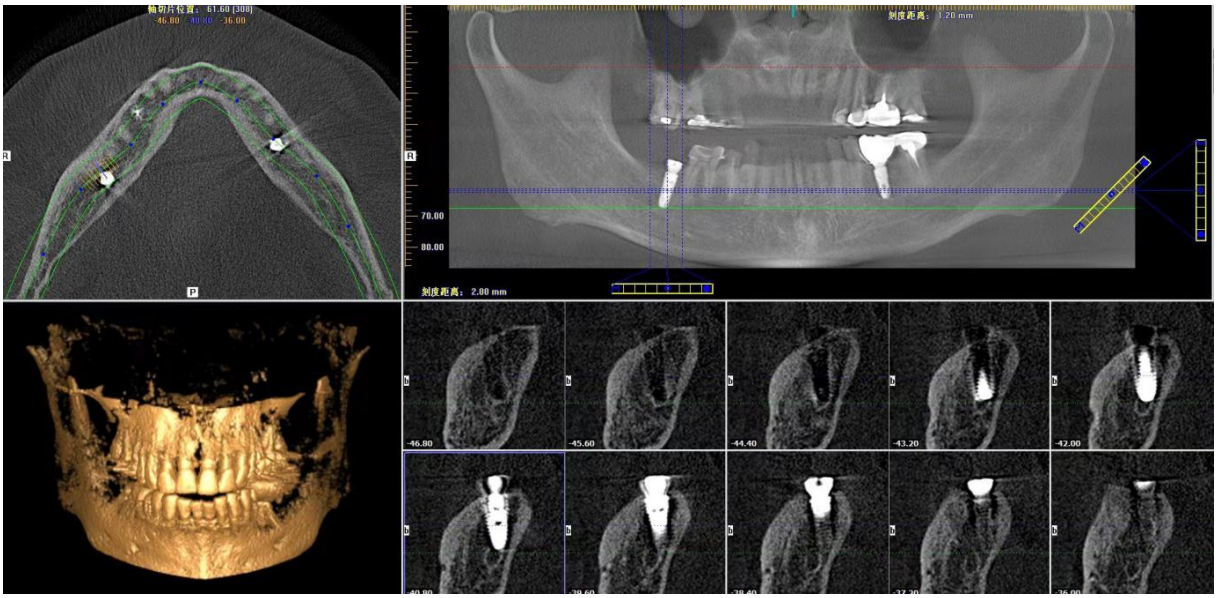
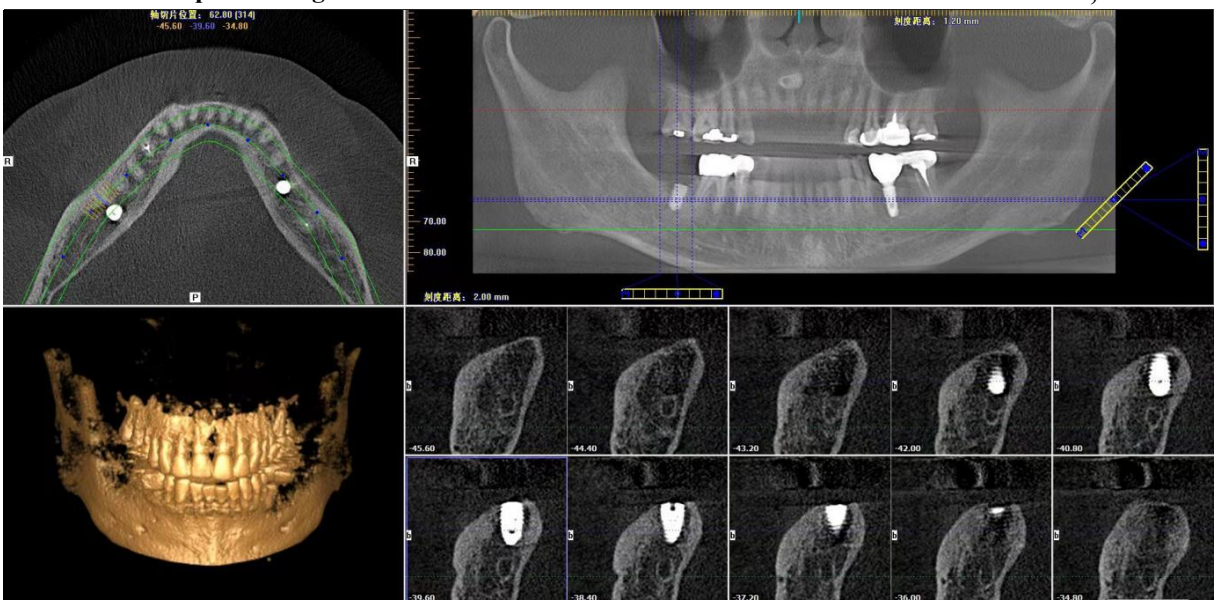


Figure 2

It can be seen that the nerve position after reimplantation has achieved good buffering

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3.3. Neurological Recovery Outcomes

The patient's neurological function was monitored quantitatively at designated follow-up intervals. The results are summarized in **Table 1**

Table 1

Timeline of Subjective and Objective Neurological Recovery

Time Point	Subjective Patient Report	Objective Findings (Light Touch,Sharp/Blunt,Two-Point Discrimination)	MRC Scale* Grade
Pre-operative	Persistent numbness and tingling	Markedly diminished sensation on all tests	S1
1 Month Post-op	Numb area decreased in size;tingling less frequent	Slight improvement in light touch perception	S2
3 Months Post-op	Occasional tingling only;numbness minimal	Clear recovery of sharp/blunt discrimination;two-point discrimination improving	S3
6 Months Post-op	Sensation nearly normal;no functional impairment	Near-normal response to all tests;minor difference from contralateral side	S3+

Note. *Medical Research Council Scale for sensory function: S0=No sensation, S1=Deep cutaneous pain, S2=Some touch and pain, S3=Return of touch and pain with static 2-PD >15mm, S3+=Return of touch and pain with 2-PD 7-15mm, S4=Complete recovery.

The patient reported a significant improvement in quality of life as the paresthesia resolved.

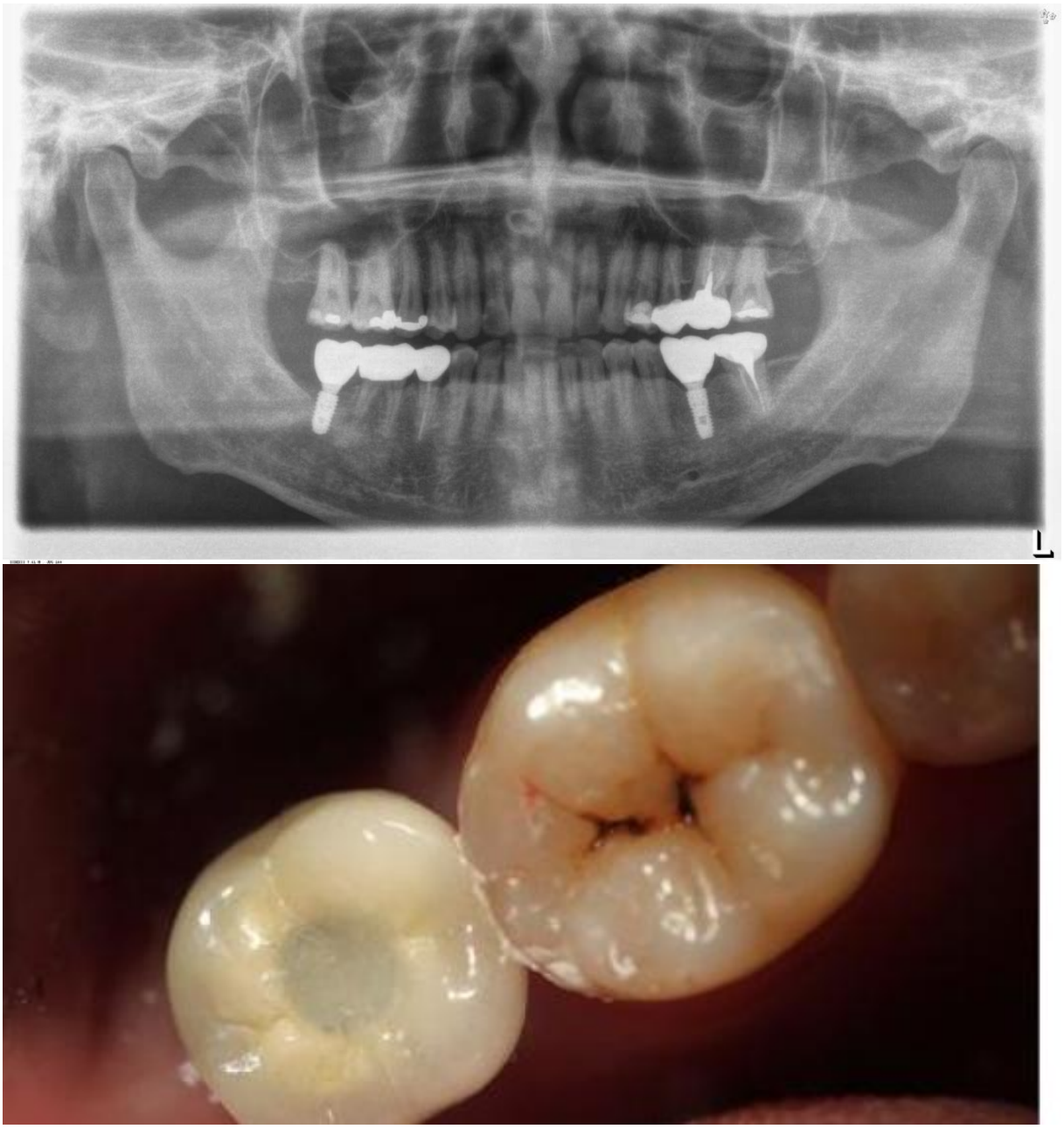
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3.4. Bone Healing and Final Prosthetic Rehabilitation

At the 4-month postoperative review, clinical examination showed complete soft tissue healing over the implant site. A follow-up CBCT scan demonstrated adequate bone fill and consolidation of the previous defect, with sufficient bone volume and density to support a prosthetic restoration. After discussing the options, the patient opted for a fixed prosthetic solution. The final rehabilitation was achieved using a custom-milled titanium abutment and a lithium disilicate all-ceramic crown, which was delivered without complications. The crown exhibited optimal occlusion, contour, and esthetic integration (**Figure 3**).

Figure 3

Intraoral view of the definitive all-ceramic crown in occlusion



4. Discussion

4.1. Etiology Analysis

The primary causes of this complication likely include: inadequate preoperative CBCT assessment or misinterpretation of the images; improper design or utilization of the surgical guide; misjudgment of anatomical landmarks during surgery; and poor control of drilling direction during osteotomy preparation.

4.2. Timing and Strategy of Management

Literature consistently indicates that earlier intervention following nerve compression leads to superior recovery outcomes. The management in this case, undertaken within X weeks postoperatively, aligns with the principle of early intervention. The key to the surgical procedure lay in the minimally invasive removal of the implant to avoid secondary trauma to the nerve, coupled with adequate decompression.

4.3. Prognosis of Neurological Recovery

Nerve recovery is a slow process, the extent and pace of which can be influenced by the degree and duration of compression, surgical technique, and individual patient factors. The favorable recovery observed in this case validates the efficacy of timely and correct surgical management.

4.4. Considerations for the Prosthetic Rehabilitation

For the secondary prosthetic phase in such cases, safety must be the paramount consideration. In scenarios where insufficient bone volume exists above the nerve canal, attempting re-implantation risks recurrence of the complication. Opting for a fixed dental prosthesis represents a safe, reliable, and functionally satisfactory alternative. Other options may include a removable partial denture or a cantilevered fixed design utilizing a more distal abutment.

4.5. Lessons Learned and Prevention

This case underscores the critical importance of mandatory preoperative CBCT examination. Furthermore, it highlights the necessity for precise planning utilizing a radiographic stent or 3D surgical navigation software, while always maintaining a safety margin of at least 2mm from critical anatomical structures.

5. Limitations

Despite providing a detailed account of the successful management and rehabilitation of a case involving implant-induced inferior alveolar nerve compression, this report is subject to several inherent limitations

5.1. Inherent Study Design Limitations

This study is a single case report, lacking a control group and having a sample size of only one. Consequently, it is not possible to perform statistical analyses to establish causality. The findings and conclusions are primarily derived from the observation and description of a single event, and their generalizability is limited. Our experience requires further validation through prospective cohort studies or case series with larger sample sizes.

5.2. Subjectivity in Neurological Assessment

Although standardized neurosensory tests (such as light touch and two-point discrimination) were employed, these evaluations still rely heavily on the patient's subjective responses and the clinician's judgment. The use of the MRC scale, while helpful, does not replace more objective quantitative sensory testing devices, potentially introducing some degree of assessment bias.

5.3. Limitations in Follow-up Duration

The follow-up period for this case was six months. While significant neurological recovery was observed, complete recovery of the inferior alveolar nerve can be a process lasting year and may sometimes be incomplete. A longer-term follow-up is necessary to determine the final stabilized state of nerve function and the long-term prognosis of the prosthesis.

5.4. Inability to Precisely Quantify Initial Damage

While CBCT can clearly depict the anatomical relationship between the implant and the nerve canal, it cannot precisely quantify the microscopic extent of axonal damage. Therefore, our assessment was based on macroscopic inference from clinical and radiographic findings, and the outcomes of surgical intervention cannot be directly correlated with a precise initial injury grade.

5.5. Specificity of the Chosen Prosthetic Solution

The final selection of a fixed dental prosthesis was based on this specific patient's anatomical conditions and personal preference. While successful in this instance, this choice does not establish it as the optimal solution for all similar scenarios. The long-term outcomes of alternative rehabilitation options (such as re-implantation or a removable partial denture) cannot be compared within this report.

6. Conclusion

In conclusion, this case report provides a comprehensive and systematic framework for the management of one of the most serious complications in implant dentistry: inferior alveolar nerve compression. Our experience underscores that the management of such cases extends beyond mere technical success, encompassing accurate diagnosis, timely intervention, and thoughtful long-term rehabilitation.

The significance of our findings is multifold. Firstly, we have demonstrated that the combination of precise CBCT diagnosis and microsurgical principles for implant removal and nerve decompression can facilitate a substantial, if not complete, return of neurological function, thereby significantly improving the patient's quality of life. Secondly, the methodical approach detailed herein—from quantitative neurosensory assessment to staged prosthetic decision-making—offers a clinically actionable protocol that can be replicated and refined by other clinicians facing similar challenges. The successful application of a fixed dental prosthesis in this context highlights that functional and aesthetic rehabilitation can be achieved safely without resorting to high-risk procedures in a compromised site.

Ultimately, the wider application of the strategies emphasized in this report lies in their power of prevention. This case serves as a critical reminder that adherence to rigorous preoperative planning protocols—including mandatory CBCT analysis and the use of surgical guides with a safe 2mm margin—is non-negotiable. It is our firm belief that this article not only contributes a valuable reference for the management of nerve injuries but, more importantly, establishes a clear standard for their prevention. We posit that this report can serve as a foundational basis for further investigation, such as larger multi-center studies comparing different nerve repair techniques or long-term outcomes of various prosthetic solutions in similar scenarios. By learning from such complications, we can collectively advance the standard of care in implant dentistry, ensuring that the pursuit of oral rehabilitation does not come at the cost of the patient's neurosensory well-being.

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Data availability

No data availability statement is required.

Declarations

Conflict of interest

The authors declare that there is no conflict of interest.

Ethics approval

Not applicable.

Consent to participate

Not applicable.

Consent for publication

Not applicable.

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