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Multidisciplinary Collaborative Treatment for Bilateral Posterior Tooth Loss Based on Occlusal Reconstruction: A Case Report

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Abstract

Objective To evaluate the value of occlusal reconstruction in multidisciplinary treatment for patients with long-standing bilateral posterior tooth loss, providing precise treatment references for complex dental arch defects with severe abrasion. Methods: A 66-year-old patient with long-standing bilateral maxillary posterior tooth loss, combined with severe full-mouth abrasion, deep overbite, and chronic apical periodontitis underwent imaging to assess alveolar bone conditions and temporomandibular joint status. The Gilbach splint precisely determined the vertical dimension of occlusion (elevated by 5 mm). Using impressions and CAD/CAM technology to fabricate a splint for occlusal elevation, establishing the correct vertical dimension. This restored the patient's lower third facial height, chewing function, and aesthetic appearance. Treatment was implemented in four phases: basic therapy, occlusal adjustment, final restoration, and long-term maintenance. Outcomes were evaluated during a 3-year postoperative follow-up. Results: Occlusal reconstruction restored normal lower third facial height with significantly improved masticatory function. Implant osseointegration remained stable throughout follow-up, with no ceramic fractures or prosthetic loosening. Temporomandibular joint function was normal, and patient satisfaction was high. Conclusion Occlusal reconstruction effectively restores masticatory function in patients with long-standing bilateral posterior tooth loss, improves occlusal relationships, and maintains long-term stability.

Keywords

Occlusal reconstruction; Multidisciplinary approach; Occlusion; Vertical dimension; Jaw position; Wear.

1. INTRODUCTION

Molars are the largest and most functionally robust teeth in the oral cavity. Their broad crowns feature interlocking cusps and fossae on the occlusal surface, providing stable occlusal relationships and powerful masticatory forces. Molars are frequently lost due to caries and periodontal disease. Molar loss significantly impacts the quality of life in middle-aged and elderly individuals. Many patients do not prioritize treatment after unilateral molar loss until bilateral posterior tooth loss further compromises masticatory function. Long-term bilateral posterior tooth loss reduces chewing efficiency, further compromising masticatory function and potentially leading to temporomandibular joint disorders. Patients with long-standing masticatory system disorders require re-establishment of occlusal relationships. Only after joint and muscle adaptation can further restoration proceed. Occlusal reconstruction is one method to restore occlusal relationships. By restoring missing or damaged dentition, vertical and jaw positional relationships are re-established, promoting coordination and stability of the masticatory muscles and temporomandibular joint system [1]. This case involves a patient with bilateral posterior tooth loss spanning several years. Prolonged absence of posterior teeth led

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to severe anterior tooth wear, insufficient space for bilateral posterior restorations, and reduced lower third facial height.

2. CASE DETAILS

A 66-year-old male patient presented to our department due to masticatory difficulties caused by bilateral posterior tooth loss. Extraoral examination revealed facial symmetry, reduced lower third facial height, 3-finger mouth opening with a downward-pointing mouth shape, symmetrical joint movement without pain or clicking, and no muscle or joint pain at rest or during movement. Bilateral masseter muscle palpation showed no tenderness or discomfort.

1) Intraoral examination: Revealed missing teeth 16, 17, 26, and 27. The anterior teeth exhibited a Class III deep overbite. The entire dentition showed Grade II abrasion. A fistula was visible on the buccal surfaces of teeth 32 and 31. Probe response was negative (-), percussion response was positive (+), cold sensitivity was absent (no response), and no mobility was noted. Teeth 16, 17, 26, and 37 were missing. No significant abnormalities were observed in the mucosa of the edentulous areas.

Figure 1. Intraoral photograph

2) Imaging examination: A full-mouth CBCT (cone-beam computed tomography) scan was performed to obtain a three-dimensional digital model of the alveolar bone. This revealed low-density shadows around the roots of teeth 31 and 32 (indicating chronic apical periodontitis). Precise measurements of alveolar bone height, width, and density were taken in the edentulous areas of teeth 16, 17, 26, and 27, confirming suitability for implant placement. Digital panoramic radiographs analyzed elongation of teeth 36, 37, 46, and 47 and assessed overall alveolar bone resorption.

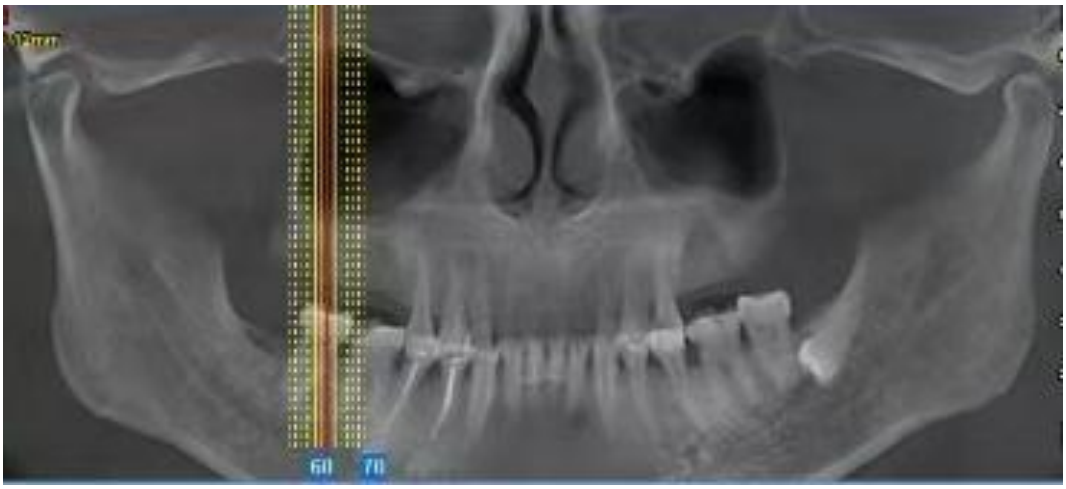

Figure 2. Imaging Findings

3) Temporomandibular Joint Examination: Bilateral temporomandibular joints symmetrical with no significant abnormalities in the joint space. condyles showed no significant morphological changes, and the disc-condyle relationship was normal.

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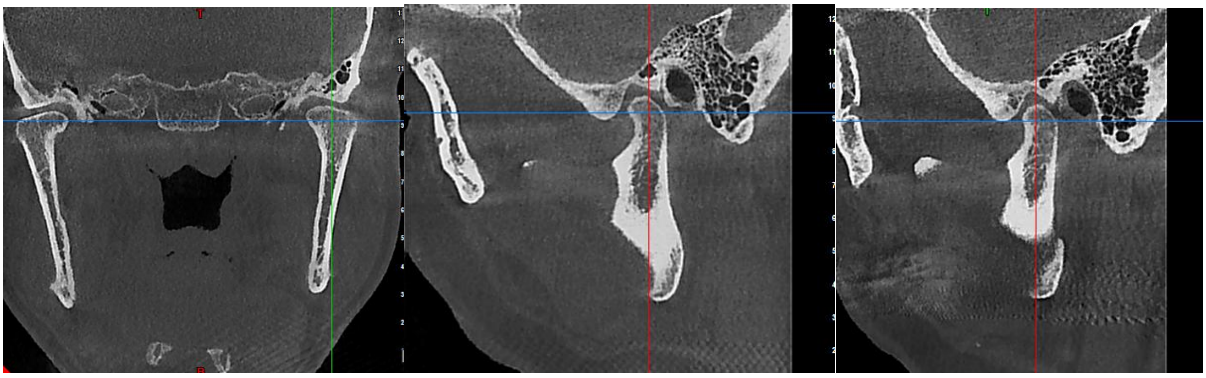

Figure 3. Imaging of bilateral temporomandibular joints

3. DIAGNOSIS

1) Missing teeth 16, 17, 26, 27 (due to elongation of 36, 37, 46, 47), 2) Severe Grade III wear throughout the dentition, 3) Compensatory elongation of 11, 12, 21, 22; severe wear of 34-44; tooth structure loss in 44, 45, 4) Chronic apical periodontitis in 31, 32.

4. TREATMENT PLAN

1) Restore occlusion and create space with a padded partial removable denture. 2) After 1 month of adaptation with the padded partial denture, place implants in teeth 16, 17, 26, and 27. 3) Complete root canal treatment for teeth 34-44. 4) Perform final restoration after stabilization of the temporomandibular joint system.

5. TREATMENT TIMELINE

1) Complete root canal therapy for 31 and 32 prior to treatment, along with comprehensive periodontal therapy for the entire dentition (2020.12.25–2021.01.24).

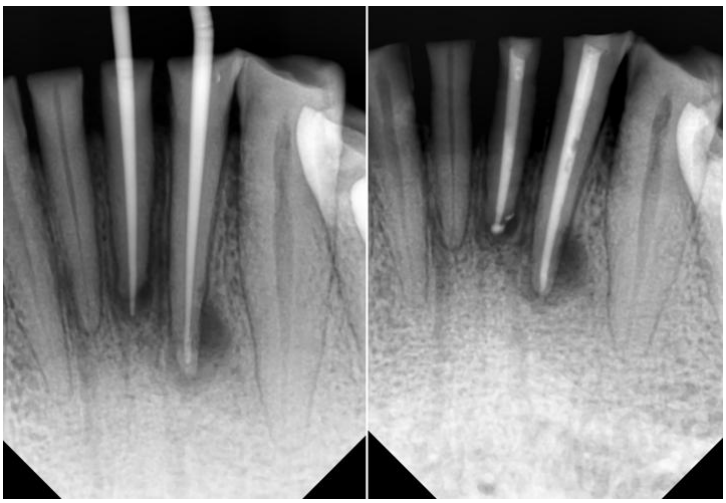

Figure 4. Completion of root canal treatment for teeth 31 and 32

2) Transfer occlusal relationship to Gilbach digital articulator for occlusal movement simulation

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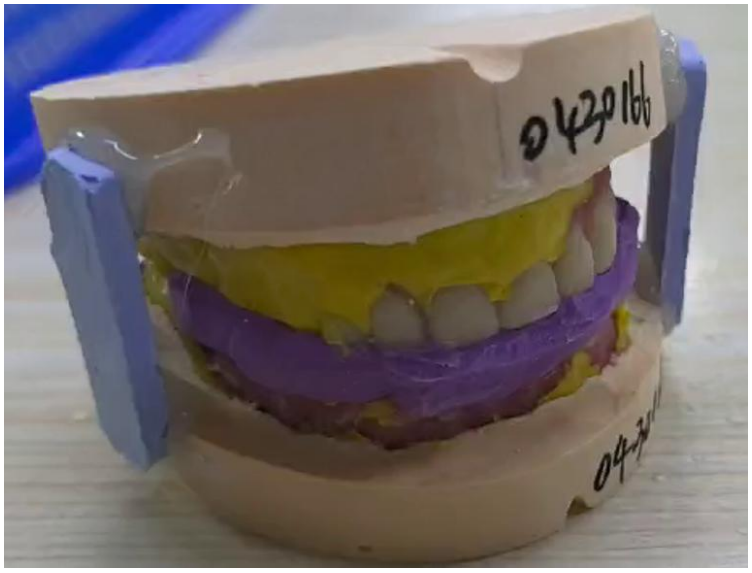

Figure 5. Gerber Digital Articulator

3) Utilizing the Gerber Digital Articulator to simulate occlusal movement, precisely determine vertical dimension elevation of 5mm.

Figure 6. Determination of 5mm vertical dimension of occlusion

4) Fabricate a customized removable partial denture with a padded base using CAD/CAM technology. The patient initially wears it for 2 hours daily, gradually transitioning to 24-hour wear. Weekly follow-ups with digital occlusal scans allow dynamic adjustment of the occlusal relationship. Occlusal stability was achieved after 5 months. Guide the patient through adaptation over 3-6 months;

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Figure 7. Custom removable jaw pad trial fitting

5) Implant restoration in rows 16, 17, 26, 27 (March 31, 2021)

Figure 8. Post-implant imaging examination

6) After 8 months of occlusal pad wear with no significant temporomandibular joint or muscle discomfort, implant crown impressions were taken and restorations were placed (August 9, 2021)

Figure 9. Intraoral view of implant-supported denture

7) Full crown restoration on mandibular teeth 35-45

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Figure 10. Intraoral view of anterior mandibular full crown restoration

8) Protective bite guard wear

Figure 11. Protective bite guard in place

6. TREATMENT OUTCOMES

6.1. Short-term Outcomes

One-month follow-up revealed restoration of normal lower third facial height with harmonious facial contours. The prosthesis exhibited color and morphology consistent with natural teeth, with excellent marginal adaptation. Normal mouth opening range and posture were maintained without temporomandibular joint discomfort. Masticatory function showed significant improvement, with no noticeable pain or discomfort during consumption of hard foods.

Figure 12. One-month postoperative follow-up, pre- and postoperative comparison

Imaging Follow-up: No significant alveolar bone resorption was observed. No marked widening of the periodontal ligament space was noted. No significant peri-implant bone resorption or shadows were detected around the implant.

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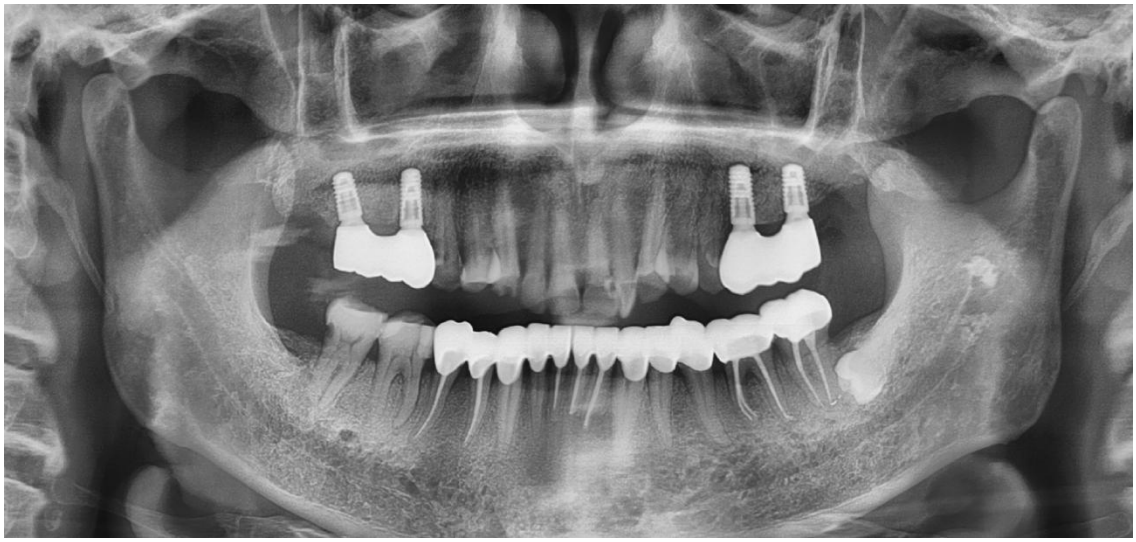

Figure 13. Radiographic follow-up at one month post-surgery

6.2. Long-term Outcomes

Three-year postoperative follow-up (as of August 2024) revealed consistent occlusal harmony with no premature contacts or interferences. The prosthesis showed no chipping, damage, or loosening, and the patient expressed high satisfaction with treatment outcomes and functional recovery. Comparison of preoperative and three-year postoperative digital models demonstrated stable maintenance of dental arch morphology, occlusal relationships, and facial proportions.

Figure 14. Intraoral examination at 3 years post-treatment

3-Year Radiographic Follow-up: Regular radiographic examinations revealed peri-implant bone resorption <0.5 mm/year with stable osseointegration. No significant widening of periodontal ligament space or alveolar bone resorption was observed.

Figure 15. Radiographic follow-up at 3 years post-op

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7. DISCUSSION AND SUMMARY

Full-mouth occlusal reconstruction is a complex, multidisciplinary sequential treatment. Precise occlusal relationship assessment, design, and implementation are critical to treatment success. Dedication to restoring the patient's correct occlusal relationship is key to success, avoiding temporomandibular joint damage [2].

1) The complexity of this case primarily manifested in:

Long-standing posterior tooth loss: The patient had been missing posterior teeth bilaterally for several years, with posterior gingival height insufficient at <3 mm, resulting in inadequate occlusal space to support implant restoration.

Uncertainty in jaw position: Long-term bilateral posterior tooth loss resulted in loss of vertical dimension and severe wear of the lower anterior teeth.

Coexisting multidisciplinary issues: Beyond prosthetic needs, concerns included periodontal tissue health, anterior aesthetic zone defects, and tooth structure problems. Thus, accurate preoperative diagnosis was essential for treatment success [3].

Through comprehensive clinical examination, radiographic analysis (panoramic radiograph, CBCT), and diagnostic wax-up/articulator analysis, this case established a restoration goal centered on restoring physiological vertical dimension and midline relationship, guiding subsequent treatment.

2) Basis for Treatment Strategy Decision and Sequence Design

Given the aforementioned complexity, this case adopted a systematic strategy of "multidisciplinary collaboration with phased implementation." Core decisions and their rationale included:

Establishing Jaw Position

Transferring the patient's occlusal relationship to a Gerber articulator to elevate the occlusion, positioning the mandible in a reproducible centric relation, and reconstructing physiological vertical dimension at this position. This provided a stable, predictable biomechanical foundation for the entire reconstruction.

Application of Therapeutic Occlusal Pads

Each treatment step must be meticulously executed without haste. Trial fitting of the removable occlusal reconstruction pad should follow the protocol for removable dentures: starting with 2 hours daily, progressing to 24-hour wear after adaptation, and permitting eating only after full adaptation. Weekly follow-ups during the trial period included occlusal adjustments. The pad was adjusted two weeks after achieving full functional eating capacity, with permanent restoration scheduled at 8 months.

3) In-Depth Analysis of Clinical Outcomes and Unexpected Findings

The clinical outcomes of this case not only validated the treatment plan's effectiveness but also yielded deeper observations:

Functional and Symptom Improvement

Enhanced masticatory efficiency and resolution of joint symptoms directly confirm the decisive role of restoring correct occlusal relationships in improving oral-maxillofacial system function. This aligns with the "physiological occlusion" theory proposed by Dawson et al [4].

Dual Benefits in Aesthetics and Psychology

Restoration guided by anterior teeth and smile reconstruction significantly boosted the patient's self-confidence, embodying the modern restorative philosophy of "function-driven with equal emphasis on aesthetics" [5].

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4) A noteworthy long-term finding

During a three-year follow-up, we unexpectedly observed significant improvement in the patient's pre-existing limited gingivitis. This may be attributed to the restoration's precise marginal adaptation, smooth surface morphology, and the enhanced cleanability of the reconstructed occlusal plane [6]. Although this is an observation from a single case, it suggests that a well-designed occlusal reconstruction may offer benefits beyond mere hard tissue restoration, potentially exerting positive effects on the long-term health of periodontal tissues.

8. CONCLUSION

This case report systematically documents the entire process of complex occlusal reconstruction—from diagnosis and design to execution and follow-up—validating the importance of patient-centered, multidisciplinary sequential treatment grounded in biological principles [7, 8]. While the case has its unique characteristics, the rigorous diagnostic approach, phased treatment strategy, and attention to functional and aesthetic details demonstrated herein provide valuable reference for clinicians managing similar complex restorative cases. Future integration of long-term occlusal analysis techniques will further deepen our understanding of the long-term stability of occlusal reconstruction.

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