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Case Report

Revolutionizing full-mouth rehabilitation: digital integration of Hobo's philosophy with CAD/CAM multilayered zirconia crowns: a case report

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ABSTRACT

Severe occlusal wear disrupts function, aesthetics, and occlusal harmony. Hobo's twin-stage philosophy offers a structured approach to full-mouth rehabilitation. Integrating this with CAD/CAM technology enhances precision and clinical outcomes. A 28-year-old male with generalized tooth wear and compromised function underwent full-mouth rehabilitation. Vertical dimension was increased by 2 mm following occlusal splint evaluation. Hobo's twin-stage technique was applied using a semi-adjustable articulator. Digital impressions and CAD/CAM workflows facilitated the fabrication of multilayered zirconia crowns.The patient showed excellent adaptation to the increased vertical dimension. Functional occlusion with canine guidance and posterior disclusion was achieved. The final restorations demonstrated precise fit, esthetics, and occlusal stability, with high patient satisfaction. Digital integration of Hobo's twin-stage protocol with CAD/CAM zirconia restorations offers a predictable, efficient, and esthetically superior solution for managing severe tooth wear.

Keywords: Full-mouth rehabilitation, Hobo's twin-stage, CAD/CAM, Zrconia crowns, Digital dentistry

INTRODUCTION

The gradual wear of the occlusal surfaces of teeth is an ongoing process throughout an individual's life. Excessive wear can lead to various complications such as aesthetic deformities, occlusal disharmony, impaired function, and even pulpal damage. The etiology of tooth wear is multifactorial, involving factors like attrition, chemical erosion, abrasion, and non-carious cervical abfraction. This wear can disrupt the functional harmony of the stomatognathic system, requiring careful diagnosis and treatment planning before proceeding with full-mouth rehabilitation.[1,2]

Maintaining the vertical dimension of occlusion (VDO) through continuous eruption of teeth compensates for the loss of tooth structure. However, in cases of severe wear, insufficient restorative space becomes a challenge, making the establishment of an adequate VDO essential to meet the functional, aesthetic, and periodontal objectives.[3,4] Several occlusal philosophies and concepts, including the Gnathological concept, Pankey-Mann-Schuyler concept, Hobo twin table concept, Hobo and Takayama twin stage philosophy, Youdelis concept, and Nyman and Lindhe concept, provide a structured approach to restoring occlusal form, function, and aesthetics.[5,6]

This case report described the rehabilitation of severely worn dentition using the Hobo twin-stage procedure integrated with CAD/CAM zirconia crowns, aiming to restore optimal occlusion and aesthetics.

CASE REPORT

A 28-year-old male patient presented with the chief complaints of an unesthetic appearance of teeth and difficulty chewing. Clinical examination revealed generalized occlusal wear, with altered speech patterns due

to the changes in tooth structure (Figure 1). There was no evidence of temporomandibular joint (TMJ) dysfunction or masticatory muscle tenderness. An assessment of the vertical dimension indicated an interocclusal distance of approximately 6 mm, which could be restored by increasing the vertical dimension by 2 mm.

The treatment plan focused on restoring the occlusal and aesthetic function by increasing the vertical dimension, addressing the wear with full-coverage all-ceramic crowns, and utilizing canine-guided occlusion to ensure both functional and aesthetic restoration.[7]

Objectives of rehabilitation

The objectives of this study were (a) rehabilitate the entire mutilated dentition in harmony with stomatognathic system; (b) establish harmony between esthetic and function; and (c) canine-guided disocclusion on lateral excursions and mutually protected occlusion anteroposteriorly.

Treatment protocol

During preliminary phase, hard acrylic splint was provided for two months to evaluate the patient's adaptation to the increased vertical dimension. During this period, there was no discomfort reported in the TMJ or masticatory muscles. Occlusal equilibration was performed in the patient's mouth by removing static and dynamic occlusal interferences. Diagnostic casts were obtained using primary impressions (alginate, tropicalgin, zhermack), and the bite registration procedure was accomplished using a Lucia jig and polyvinyl siloxane occlusal registration material (jet bite). The casts were mounted on a semi-adjustable articulator (HANAU articulator mode Wide-Vue, USA) using face bow records (Spring-bow; Teledyne, USA) at the planned 2-mm increase in VDO (Figure 2). In Hobo's twin-stage procedure semi-adjustable articulator was adjusted according to condition 1 of Hobo's philosophy, and posterior diagnostic wax-ups were performed to achieve bilateral balanced occlusion. Smooth gliding contacts from CR to protrusive and lateral movements were established for posterior wax up. Condition 2 was applied after establishing anterior guidance with adjusted palatal contours, ensuring mutually protected occlusion and uniform posterior disocclusion during eccentric movement (Figure 3) (Table 1).[8] During definitive phase crown lengthening was performed on both maxillary and mandibular anteriors to achieve proper crown-root ratios.[9] Provisional crowns were fabricated from the diagnostic wax-ups and cemented temporarily (NETC) (Figure 3) After a one-month trial period, an assessment of the patient's adaptation to new vertical dimensions and the occlusal scheme was checked. Impressions of adjusted provisionals were made, and the diagnostic casts were remounted on the semi-adjustable articulator. Customized guide tables were fabricated using pattern resin. Crown preparations were refined and digital intraoral scanning were performed all prepared teeth, followed by face bow transfer and interocclusal records (Figure 5 and 6) 3D printed models were articulated using facebow and an interocclusal record on a semi-adjustable Hanau articulator. Zirconia copings were designed and milled using EXOCAD software, and marginal adaptation was verified intraorally (Figure 4). After layering the ceramic material, occlusal adjustments were finalized using conditions 1, 2 and a customized guide table on semi- adjustable Hanau articulator (Figure 5). Final Restoration the unglazed zirconia crowns were tried intraorally, and canine guidance was verified (Figure 6). The final glazed zirconia crowns were first cemented with zinc phosphate cement and later finalized with resin-modified glass ionomer cement after a 15-day adaptation period (Figure 7).[10] Oral hygiene instructions were provided, and the patient was scheduled for regular follow-up visits to ensure long-term success. The patient was satisfied with aesthetic and functional outcomes.

Table 1: Values of condition 1 and condition 2 according to the Hobo twin- stage technique (values in degrees).

Condition	Horizontal condylar guidance	Lateral condylar guidance	Anterior guidance	Lateral anterior guidance
1	25	15	25	10
2	40	15	45	20

Figure 1: Pre-op intraoral photographs.

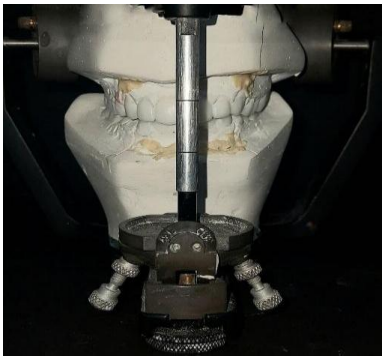

Figure 2: Diagnostic wax mock.

Figure 3: Immediate temporization and establishing occlusal scheme.

Figure 4: Coping designing using EXO CAD software.

Figure 5: Occlusal equilibration on articulator.

Figure 6: Unglazed trial.

Figure 7: Final prosthesis.

DISCUSSION

Restoring severely worn dentition requires a comprehensive approach to re-establish occlusal balance, vertical dimension, and aesthetics. In this case, a 2-mm increase in vertical dimension (VDO) was planned and successfully achieved using Hobo's twin-stage procedure in conjunction with CAD/CAM zirconia crowns, addressing both functional and aesthetic concerns.[5,6] CAD/CAM zirconia is ideal for full mouth rehabilitation due to its high strength, durability, and precision fit. It resists fractures, offers excellent biocompatibility, and supports long-term function under heavy occlusal loads. Modern translucent zirconia also provides improved esthetics, making it suitable for both anterior and posterior restorations. The digital workflow ensures accuracy, consistency, and efficiency, leading to predictable outcomes and minimal adjustments.[15] Provisional restorations were employed to evaluate the patient's adaptation to the increased VDO and modified occlusal scheme. No discomfort or TMJ symptoms were reported during the trial phase, confirming the appropriateness of the planned changes to the VDO.[3,4]

The Hobo twin-stage procedure ensured controlled occlusal adjustments, with the first stage establishing balanced posterior contacts and the second stage refining anterior guidance to create mutually protected occlusion. This staged approach minimizes the risk of TMJ dysfunction and ensures long-term functional stability, aligning with established occlusal principles.[7,8] The use of digital technologies, such as intraoral scanning and CAD/CAM design, enhanced the precision of the restorations, enabling more accurate impressions and optimized zirconia copings. Digital workflows reduced fabrication time and ensured better marginal adaptation, improving overall treatment efficiency.[11,12]

The provisional phase, using diagnostic wax-ups, provided an opportunity to assess the patient's response to the increased VDO and occlusal modifications. This real-time evaluation allowed for necessary adjustments before finalizing the restoration. The definitive zirconia crowns were cemented in a two-step process, ensuring occlusal refinement and long-term stability. The patient was highly satisfied with both functional and aesthetic outcomes, reflecting the success of the treatment approach.[9]

This case underscores the value of integrating Hobo's twin-stage philosophy with modern digital tools to achieve optimal functional and aesthetic outcomes in full-mouth rehabilitation. The use of digital technologies enhances precision and efficiency, while the controlled occlusal adjustments ensure predictable, stable results with improved masticatory efficiency and esthetics. Further studies are warranted to evaluate the long-term efficacy of this integrated approach in larger patient populations.[13,14]

CONCLUSION

The Hobo twin-stage philosophy, when combined with modern digital tools like CAD/CAM technology, provides a reliable framework for full-mouth rehabilitation. This integrated approach ensures that occlusal balance, vertical dimension, and aesthetic requirements are met with precision, leading to long-term functional stability. The success of this case emphasizes the potential of combining established occlusal principles with cutting-edge digital technology in achieving optimal restorative outcomes. Further studies are warranted to confirm the long-term efficacy of this approach in larger patient populations.

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