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Digitally Guided Rehabilitation Following Vertical Dimension Increase: A Case Report

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Abstract:
Deep bite associated with loss of vertical dimension of occlusion (VDO) represents a significant restorative challenge requiring accurate diagnosis and careful treatment planning. This case report describes the rehabilitation of a 21-year-old male patient presenting with severe tooth wear, reduced VDO, and multiple inadequate restorations associated with endodontic complications.
A digitally guided workflow combined with occlusal deprogramming using a Leaf Gauge was used to establish a reproducible mandibular position and increase the VDO. Following digital analysis and mock-up validation, the maxillary anterior teeth were restored with monolithic multilayer zirconia crowns to establish stable anterior and canine guidance. Mandibular posterior teeth were rehabilitated using CAD/CAM composite-ceramic endocrowns, onlays, and overlays, while the mandibular anterior teeth were restored using an injectable composite technique.
Clinical follow-up at 6 months and 1 year demonstrated stable functional and esthetic outcomes without mechanical complications. This case highlights the effectiveness of combining digital planning, occlusal management, and a minimally invasive multimaterial restorative approach in the rehabilitation of complex worn dentition cases. Furthermore, the step-by-step digital workflow contributed to predictable and stable results, while potentially reducing the risk of future restorative failures.

Keywords*: Deep bite; Vertical dimension of occlusion; Digital workflow; Zirconia crowns; Endocrowns; Injectable composite*

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I. Introduction

Severe tooth wear associated with deep bite and reduction in vertical dimension of occlusion (VDO) represents a complex restorative condition that challenges both functional rehabilitation and long-term stability. Although physiological wear may be compensated by dentoalveolar adaptation, advanced cases often exceed the adaptive capacity of the stomatognathic system, leading to compromised esthetics, reduced occlusal vertical dimension, and altered mandibular dynamics [1,3].

A critical step in managing such cases is the establishment of a reproducible mandibular position and determination of a clinically acceptable increase in VDO. Occlusal deprogramming techniques using devices such as a Leaf Gauge are widely used to eliminate proprioceptive interferences and facilitate accurate centric relation recording [2]. Careful validation of the proposed VDO is essential, particularly in young patients with long-term functional demands.

The integration of digital technologies has significantly improved full mouth rehabilitation protocols. Digital workflows allow virtual articulation, occlusal simulation, and precise control of restorative space, enhancing treatment planning and predictability [4]. Recent clinical studies have demonstrated that digitally guided rehabilitation, including cases involving increased VDO, can achieve stable and predictable long-term outcomes [5]. Furthermore, systematic reviews have shown that digital prosthodontic workflows improve communication between clinician and technician and increase reproducibility in complex rehabilitations [6-8].

Recent evidence also emphasizes the importance of transitional evaluation phases when increasing VDO. Chantler et al. reported that provisional restorations and adaptation periods play a significant role in assessing patient comfort, function, phonetics, and occlusal stability before definitive treatment [10]. Such evaluation phases may help reduce complications and improve the predictability of complex full mouth rehabilitation cases.

Material selection also plays a key role in treatment success. Monolithic zirconia offers high strength and fracture resistance, making it suitable for anterior restorations and establishment of guidance [11]. In contrast, composite-ceramic CAD/CAM materials provide improved stress distribution and adhesive bonding, making

them suitable for posterior restorations such as endocrowns and overlays [13]. Recent studies further support biomimetic and multimaterial restorative approaches aimed at optimizing biomechanical behavior and reducing catastrophic failures [14,15].

This report presents a digitally planned, minimally invasive, multimaterial rehabilitation of a young patient with deep bite and reduced VDO using a biomechanically guided restorative approach.

II. Case Report

A 21-year-old male patient presented with complaints of poor esthetics and functional discomfort associated with worn dentition and previous inadequate dental treatment (Figure 1-3).

Clinical examination revealed a deep bite with reduced vertical dimension of occlusion (VDO) and significant wear of the lower mandibular anterior teeth, resulting in short clinical crowns of the lower incisors and canines.

Multiple defective restorations and carious lesions were present in the posterior lower region. The mandibular left second premolar was missing and previously treated mandibular molars showed inadequate endodontic therapy. An asymptomatic supernumerary central tooth was also present and did not require intervention.

Figure 1-3. Preoperative extraoral views showing the patient at rest, smiling, and maximum smile.

The patient had a history of dental trauma in the maxillary anterior region. Existing zirconia crowns on the maxillary left central and lateral incisors showed poor esthetics, including shade mismatch and improper morphology.

Radiographic examination revealed a periapical lesion associated with the maxillary lateral incisor as well as inadequate root canal treatment (Figure 4).

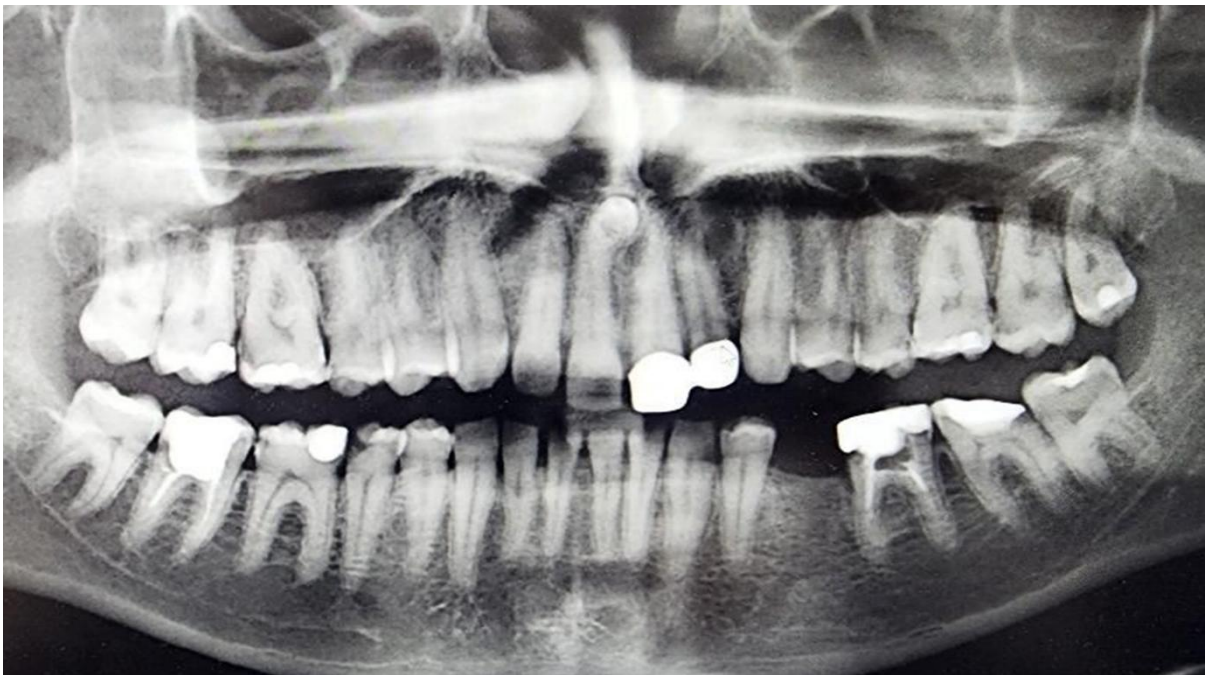

Figure 4. Preoperative panoramic radiograph demonstrating compromised dentition and inadequate previous treatments.

Figure 5. Preoperative intraoral view showing deep bite and severe anterior wear

Figure 6. Clinical view after removal of previous zirconia crowns

Treatment Planning

The primary objectives were:

- Increase VDO in a controlled and reversible manner
- Restore function and esthetics
- Establish stable anterior and canine guidance
- Preserve tooth structure using minimally invasive techniques

Perform nonsurgical endodontic retreatment"

Digital workflow

Occlusal deprogramming was performed using a Leaf Gauge to obtain a reproducible mandibular position and determine the proposed increase in VDO. Initial intraoral scans were taken at the existing VDO, followed by a second scan after bite registration at the increased VDO. A complete digital wax-up and virtual articulation were then created for treatment planning.

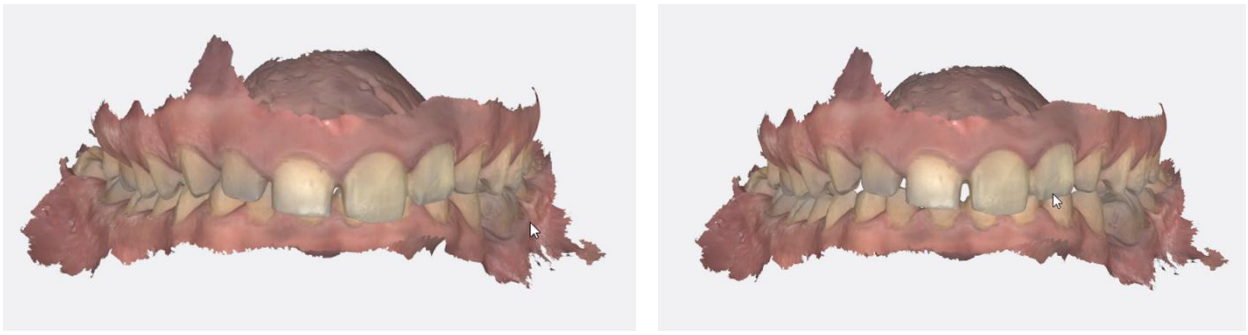

Figure 7. Initial intraoral digital scan at the existing vertical dimension of occlusion (left) and second scan after occlusal deprogramming with a Leaf Gauge and increase of VDO (right).

Figure 8. Digital wax-up and mock-up validation at the increased vertical dimension of occlusion used to evaluate esthetics, occlusion, and restorative space.

Based on the digital analysis, monolithic zirconia crowns were planned for the maxillary anterior teeth to provide durable anterior and canine guidance. High Impact Polymer Composite (HIPC),CAD/CAM restorations were selected for the mandibular posterior teeth because of their favorable stress distribution and adhesive properties. The mandibular anterior teeth were planned for restoration using an injectable composite technique.
A full digital wax-up was fabricated at the proposed VDO, and printed models together with an intraoral mock-up were used to evaluate esthetics, phonetics, and occlusion. Following successful validation and patient approval, treatment was initiated.

The existing maxillary crowns were removed, and endodontic retreatment of the maxillary lateral incisor was performed. Obturation was completed using a bioceramic sealer, followed by immediate placement of a fiber post and core. Subsequently, six maxillary anterior teeth were prepared, and final impressions were obtained.

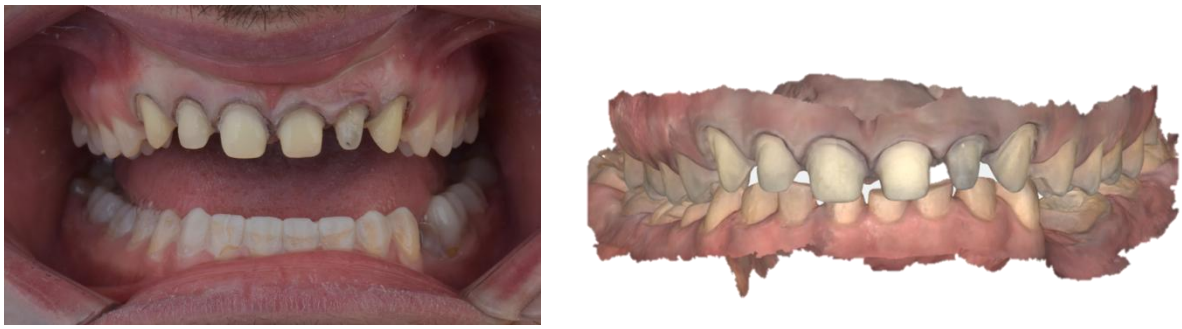

Figure 9. Intraoral clinical view and digital scan after preparation of the maxillary anterior teeth at the increased vertical dimension of occlusion

In the mandibular arch, inadequate endodontic treatments of the molars were retreated, carious lesions were removed, and defective restorations were replaced. Endocrowns were planned for endodontically treated molars, while overlays and onlays were prepared for the remaining posterior teeth.

Before definitive treatment, CAD/CAM PMMA provisional restorations were fabricated and tried in to evaluate patient adaptation, functional movements, and occlusion at the increased VDO. The provisional phase confirmed satisfactory esthetics, phonetics, and functional adaptation.

Definitive restorations were then fabricated and delivered. The maxillary arch was restored with six monolithic multilayer zirconia crowns designed to establish stable anterior and canine guidance. The mandibular posterior teeth were restored using High Impact Polymer Composite (HIPC) Bredent,CAD/CAM endocrowns, overlays, and onlays selected for their biomechanical behavior and wear compatibility with zirconia.

Figure 10. Monolithic zirconia crowns and onlays and endocrowns on 3D-printed models before final cementation

For restoration of the mandibular anterior teeth, a transparent silicone index derived from the digital wax-up was fabricated. Using this index, an injectable composite technique with GC Composite was performed to conservatively restore morphology and function.

Final occlusal adjustments were performed to achieve stable occlusion at the increased VDO together with functional anterior and canine guidance. Follow-up examinations at 6 months and 1 year demonstrated stable occlusion, maintenance of VDO, satisfactory esthetics, and absence of fractures or debonding. Implant placement is planned in the future for rehabilitation of the missing mandibular second premolar.

Figure 11. Immediate postoperative result following cementation of definitive restorations and injectable composite rehabilitation of the mandibular anterior teeth.

Figure 12. Extraoral and intraoral views at 1-year follow-up showing stable occlusion, maintained vertical dimension, and satisfactory esthetic integration of the restorations.

Figure 13. Final intraoral view after completion of full mouth rehabilitation.

II. Discussion

Full mouth rehabilitation in patients presenting with deep bite and loss of vertical dimension of occlusion (VDO) remains a complex clinical challenge that requires careful integration of occlusal principles, material science, and modern digital workflows. The present case illustrates a structured approach combining conventional occlusal management with digital planning and a multimaterial restorative strategy.

A key aspect of this treatment was the controlled increase of VDO. It has long been debated whether VDO is truly lost in cases of tooth wear or maintained through dentoalveolar compensation. Turner and Missirlian proposed that while many patients maintain VDO, severe wear cases may require active intervention [1]. In agreement with this concept, the present case demonstrated clear clinical signs of reduced restorative space and functional compromise, justifying the need for VDO increase. The determination of a reproducible mandibular position is critical when altering VDO. Occlusal deprogramming using a Leaf Gauge was used in this case to eliminate proprioceptive influences and obtain a stable centric relation. This approach is supported by Dawson, who emphasized that accurate occlusal records depend on the elimination of neuromuscular engrams prior to bite registration [2]. Similarly, Okeson highlighted the importance of deprogramming in achieving reliable mandibular positioning, particularly in patients with occlusal disharmony [3].

The integration of digital technology played a central role in treatment planning and execution. Digital wax-up and virtual articulation allowed visualization of the proposed increase in VDO and facilitated communication with the dental technician. Compared to conventional analog methods, digital workflows provide improved accuracy and reproducibility, as demonstrated by Güth et al. [4]. More recent clinical reports have confirmed that digitally guided full mouth rehabilitation can achieve predictable long-term outcomes, even in cases involving significant occlusal modification [5].

Recent systematic reviews and clinical studies further support the role of digital workflows in full mouth rehabilitation. Joda et al. reported that digital prosthodontic workflows improve treatment accuracy, reduce clinical steps, and enhance communication between clinician and technician [6]. Similarly, Revilla-León and Özcan demonstrated that CAD/CAM technologies provide better control of occlusal parameters and improve reproducibility in complex rehabilitations [7]. Papaspyridakos et al. further emphasized that digital planning combined with proper clinical validation can provide predictable outcomes in cases involving increased VDO [8].

Despite these advantages, digital workflows are not independent of clinical accuracy. Errors in bite registration or mandibular positioning may be directly transferred into the final restorations. Therefore, combining digital planning with clinical validation—such as mock-ups and provisional restorations—remains essential. In the present case, PMMA provisional restorations were used to evaluate patient adaptation to the increased VDO. This step is supported by Magne and Belser, who emphasized the importance of provisionalization in assessing function, phonetics, and esthetics before definitive treatment [9]. Recent systematic reviews have also highlighted the role of evaluation phases in minimizing risk in complex rehabilitations [10].

Material selection in this case followed a biomechanical rationale aimed at optimizing load distribution and long-term durability. Monolithic multilayer zirconia was selected for the maxillary anterior region to establish stable anterior and canine guidance. Zirconia has been widely reported to exhibit high flexural strength and fracture resistance, making it suitable for load-bearing restorations [11]. Establishing a rigid anterior guidance is particularly important in cases involving VDO increase, as it helps to control occlusal forces and protect posterior restorations.

However, the high hardness of zirconia raises concerns regarding wear of opposing dentition. Clinical studies have shown that polished monolithic zirconia produces less antagonist wear compared to glazed surfaces, emphasizing the importance of proper finishing and occlusal adjustment [12]. In the present case, careful occlusal design and finishing were performed to minimize these risks.

For the mandibular posterior region, composite-ceramic CAD/CAM materials were selected for endocrowns, onlays, and overlays. These materials offer a lower modulus of elasticity compared to ceramics, allowing better absorption of occlusal forces and reducing stress concentration at the adhesive interface [13]. This property is particularly advantageous in endodontically treated teeth, where structural integrity is compromised. Furthermore, adhesive restorations allow for a minimally invasive approach, preserving remaining tooth structure and improving long-term prognosis.

Recent literature also supports the multimaterial approach used in this case. Magne et al. emphasized the importance of selecting restorative materials according to biomechanical behavior rather than solely esthetic considerations [14]. Likewise, Sasse et al. demonstrated that composite-ceramic CAD/CAM materials exhibit favorable stress distribution and reduce catastrophic failure compared with brittle ceramic restorations [15]. These findings support the use of zirconia in high-load anterior regions and composite-based materials in posterior areas to optimize functional performance.

The use of the injectable composite technique for mandibular anterior teeth reflects a conservative philosophy in managing worn dentition. This technique enables restoration of form and function without extensive tooth preparation, while maintaining compatibility with the newly established occlusal scheme. When guided by a silicone index derived from a digital wax-up, it allows precise replication of morphology and occlusion.

An important functional outcome of this treatment was the establishment of canine guidance and anterior guidance. These occlusal schemes play a critical role in distributing occlusal forces and protecting posterior teeth during excursive movements. According to Dawson, a well-designed anterior guidance reduces the load on posterior teeth and contributes to long-term stability of the occlusion [2].

The follow-up results at 6 months and 1 year demonstrated stable occlusion, maintained VDO, and absence of mechanical or biological complications. These findings are consistent with recent clinical reports indicating that combined analog-digital approaches can provide predictable outcomes in full mouth rehabilitation cases.

Nevertheless, several limitations must be acknowledged. This report describes a single clinical case, and therefore the findings cannot be generalized. In addition, the follow-up period, although clinically relevant, is relatively short for evaluating long-term material performance, particularly regarding wear and adhesive durability. Future studies with longer follow-up and larger sample sizes are required to validate these results.

III. Conclusion

This case report demonstrates that deep bite rehabilitation with loss of vertical dimension can be predictably managed using a digitally guided multimaterial approach. Careful occlusal planning, controlled VDO increase, and the use of anterior zirconia guidance combined with posterior adhesive restorations resulted in stable functional and esthetic outcomes. The step-by-step digital workflow improved treatment predictability and may contribute to reducing future restorative complications.

References

[1]. Turner KA, Missirlian DM. Restoration of the extremely worn dentition. *J Prosthet Dent.* 1984;52(4):467-474.
[2]. Dawson PE. *Functional Occlusion: From TMJ to Smile Design.* St Louis: Mosby; 2007.
[3]. Okeson JP. *Management of Temporomandibular Disorders and Occlusion.* 8th ed. St Louis: Elsevier; 2019.
[4]. Güth JF, Edelhoff D, Schweiger J, Keul C. A new method for the evaluation of the accuracy of full-arch digital impressions in vitro. *Clin Oral Investig.* 2013;17(5):1487-1494.
[5]. Luna-Domínguez CR, Bustamante-Hernández N, Torres-González G, et al. Full-mouth rehabilitation in a completely digital workflow: A clinical report. *J Esthet Restor Dent.* 2023;35(4):623-632.
[6]. Joda T, Zarone F, Ferrari M. The complete digital workflow in prosthodontics: A systematic review. *Int J Prosthodont.* 2022;35(1):15-24.
[7]. Revilla-León M, Özcan M. Additive and subtractive technologies in dentistry: Current concepts. *J Prosthet Dent.* 2023;129(4):587-593.
[8]. Papaspyridakos P, et al. Digital workflows in prosthodontics and implant dentistry: Clinical outcomes. *J Prosthet Dent.* 2024;131(2):145-154.
[9]. Magne P, Belser U. *Bonded Porcelain Restorations in the Anterior Dentition.* Chicago: Quintessence Publishing; 2003.
[10]. Chantler JGM, et al. Evaluation phase in vertical dimension increase rehabilitation: A systematic review. *J Esthet Restor Dent.* 2024;36(2):245-256.
[11]. Miyazaki T, Nakamura T, Matsumura H, Ban S, Kobayashi T. Current status of zirconia restoration. *J Prosthodont Res.* 2013;57(4):236-261.
[12]. Stawarczyk B, Özcan M, Schmutz F, Trottmann A, Roos M, Hämmerle CHF. Two-body wear rate of monolithic zirconia with different surface treatments. *J Prosthet Dent.* 2013;109(2):103-110.
[13]. Rocca GT, Krejci I. Bonded indirect restorations for posterior teeth: From cavity preparation to provisionalization. *Quintessence Int.* 2013;44(5):371-379.
[14]. Magne P, et al. Biomimetic restorative dentistry: Material selection and clinical implications. *J Esthet Restor Dent.* 2022;34(5):745-754.
[15]. Sasse M, et al. Mechanical behavior of CAD/CAM composite materials: A systematic review. *Dent Mater.* 2023;39(6):812-823.

Conflict of Interest
The authors declare no conflict of interest related to this case report.

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