

Full-Mouth Rehabilitation of a Patient with Severe Deep Bite: A Clinical Report

Gulfem Ergun, DDS, PhD & Ayse Seda Yucel, DDS

Department of Prosthodontics, Faculty of Dentistry, Gazi University, Ankara, Turkey

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Correspondence

Dr. Gulfem Ergun, Department of Prosthodontics, Faculty of Dentistry, Gazi University, Yesil Baris sitesi, No: 157 Alacaatli/Çayyolu, Ankara, Turkey.
E-mail: ergungulfem@yahoo.com, gulfem@gazi.edu.tr

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Abstract

Increasing the vertical dimension is essential to resolving problems associated with deep bite. Restorative dentistry, orthodontia, and oral surgery are the three disciplines that can help to gain the vertical dimension necessary in these patients. This clinical report presents the results of increasing vertical dimension with a full-mouth restorative treatment procedure for a 40-year-old male patient who exhibited severe deep bite. After clinical evaluation, extraoral examination showed a reduction of the lower facial height and protuberant lips, wrinkles, drooping, and overclosed commissures. In addition, intraoral examination showed a severe anterior deep-bite articulation, and upper incisors were in contact with the lower incisor labial tissue. A removable partial denture was made at increased occlusal vertical dimension (OVD) to use in the first stage of rehabilitation. Diagnostic wax-up was performed at the increased vertical dimension. Then, provisional crowns were fabricated according to this increased vertical dimension. Interim prostheses were used for 3 months as a guide for preparing the definitive restorations. The adaptation of the patient to the increased OVD was evaluated. During this period, he was asymptomatic. Following the evaluation period, definitive restorations were completed, and routine clinical assessments were made after 1 week, 1 month, 3 months, and 6 months, then after 1 and 2 years with visual and radiographic examinations.

The Glossary of Prosthodontic Terms defines *vertical dimension* as “the distance between two selected anatomic points, one on a fixed and one on a movable member.”¹ In addition, the occlusal vertical dimension (OVD) is defined as the distance measured between two points when the mandibular teeth and the maxillary teeth are in contact.² Many techniques have been reported for rating OVD³⁻⁵ (evaluating the rest vertical dimension, evaluating posterior speaking space, facial soft tissue contours, function, and cephalometrics).^{4,5} Despite these techniques, there is no exact method to determine an admissible OVD.⁶

The distance between two chosen points (one of which is on the middle of the face or nose and the other of which is on the lower face or chin) measured when the mandible is in the physiologic rest position is defined as *rest vertical dimension* (RVD).^{1,7} *Freeway space* (FWS) is the difference in vertical dimension between when the mandible is at rest and when the mandible is in occlusion.¹ A previous study stated that when the RVD and OVD are reduced, and FWS is normal, restoration of the OVD and RVD is simple. Moreover, restoration of a patient with a normal RVD, reduced OVD, and increased FWS, by reduction of FWS, is also generally applicable.⁷

Alteration in OVD causes adaptable reactions in temporomandibular joint (TMJ), periodontium, and occlusal morphology.⁸ Previous studies reported that increasing OVD during restorative procedures could be unhealthy and can disrupt a patient’s dental physiology and adaptation.^{8,9} Hyperactivity of the masticatory muscles,⁸ elevation in occlusal forces, bruxism, and temporomandibular disorders (TMDs) are reported consequences of increasing the OVD.^{2,9}

Class II deep bites are problems associated with growth and habit and are usually hereditary.^{10,11} In addition, it is often difficult to achieve good esthetic results in deep-bite patients. Restorative dentistry, orthodontics, and oral surgery can be performed to help gain the vertical dimension necessary in these patients.¹⁰ Furthermore, treatment procedures can be summarized as follows: orthodontic therapy only, surgical therapy only, combination of surgical-orthodontic approaches,¹² restorative procedures, and orthodontic therapy followed by restorative procedure.¹⁰

The purpose of this clinical report is to describe the restorative treatment of a patient with severe deep bite and Class II malocclusion. The treatment procedures include extraoral and intraoral examination, diagnosis, treatment planning, diagnostic wax-up, exploration of alternative treatment options for the



Figure 1 Pretreatment intraoral view (A) right side, (B) left side, (C) facial aspect.



Figure 2 Pretreatment radiograph.

patient, restoration and rehabilitation process, and evaluation of maintenance period.

Clinical report

A 40-year-old male patient was referred to the Department of Prosthodontics of Gazi University, with a chief complaint concerning inability to chew, problems with facial appearance, and replacement of missing teeth. A detailed dental, medical, and social history was obtained. The patient's general medical history was insignificant, and he had no TMD or pain in the masticatory muscles. Extraoral examination showed a reduction of the lower facial height and protuberant lips, wrinkles, drooping, and overclosed commissures caused by the loss of vertical dimension. The general standard of oral hygiene and gingival situation were unsatisfactory. A severe anterior deep-bite articulation was observed, and upper incisors were in contact with the lower incisal labial tissue (Fig 1). The maxillary

right lateral incisor and left first premolar had had root canal treatments. In addition, the mandibular right second molar and left first premolar had resin composite fillings. The intraoral and radiographic examination verified that the maxillary right first and second premolars, right first molar, left first premolar and first molar, mandibular left second premolar, left first molar, and right first molar were lost (Fig 2); however, the patient said that he had never used fixed or removable partial dentures (RPDs). The patient was evaluated by the orthodontist, and the diagnosis was Class II division 2 malocclusion with severe deep bite.

Alternative treatment options were described to the patient. He did not accept orthodontic treatment because of the length and difficulty of the treatment procedures. On the other hand, surgical therapy and restoration of the edentulous posterior regions with implants were offered. This treatment option was also rejected, for similar reasons (length and difficulty of procedure). Finally, prosthodontic rehabilitation was chosen.

There was an insufficient intermaxillary space for dental rehabilitation, and the goals of the treatment were to restore the patient's lost OVD, occlusion, function, and esthetics. Following increasing the OVD by interim prostheses, full-mouth rehabilitation with metal ceramic restorations was planned. Treatment procedures were defined as RPD, crown preparation, fabrication of the interim prosthesis, and fabrication of the definitive restoration.

Impressions for diagnostic casts were made with irreversible hydrocolloid (Hydrocolor 5; Zhermack, Badia Polesine, Italy) material. Diagnostic casts were attached on a semi-adjustable articulator (Stratos 200; Ivoclar Vivadent Ag, Pforzeim,

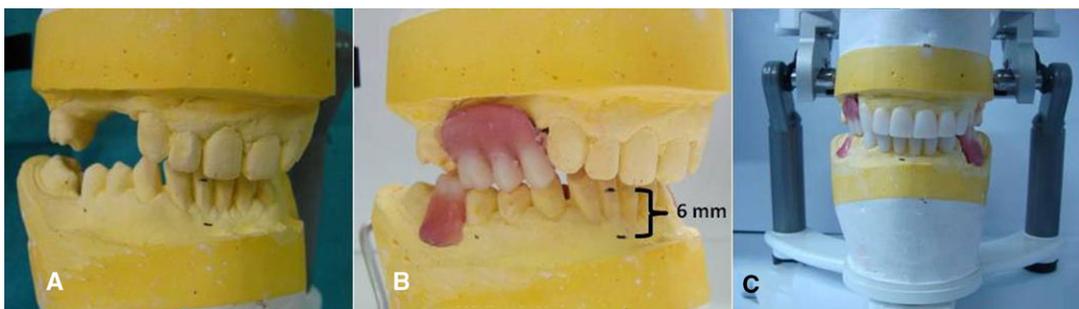


Figure 3 (A) Increased vertical dimension on the anatomic model. (B) Removable partial denture is made at increased OVD to use in the preparation stage. (C) Removable and temporary fixed restoration together.

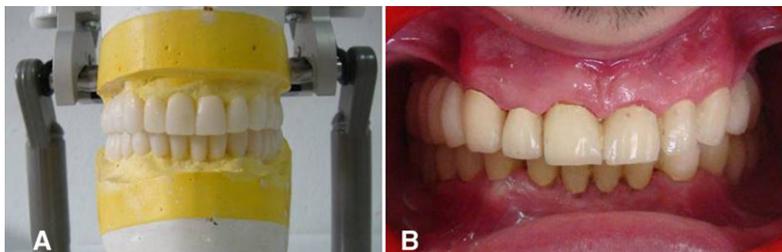


Figure 4 (A) Diagnostic wax-up of the patient at increased OVD. (B) Fixed interim prosthesis for adaptation period.

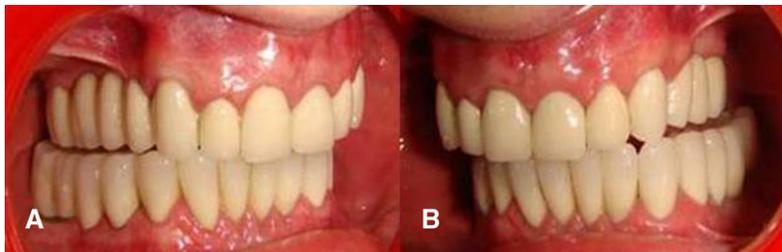


Figure 5 Intraoral view showing the mutually protected occlusion scheme after treatment (A) right side, (B) left side.



Figure 6 (A) Intraoral view at the end of prosthodontic treatment. (B) The patient's smile at the end of treatment. (C) Pretreatment profile. (D) Posttreatment profile showing the marked esthetic improvement in the lower facial height.

Germany) in centric occlusion. The patient's FWS was 7 mm (difference between RVD and OVD). A previous study stated that the FWS should range between 1 and 3 mm.¹³ Thus, to restore the patient's dentition and obtain an optimal facial appearance, the OVD could be increased approximately 4 to 6 mm. Therefore, in the present case, the OVD was increased approximately 6 mm. A maxillomandibular occlusal bite registration material (Take 1[®] Advanced; Kerr, Scafati, Italy) was used to determine the centric relation occlusal record at this OVD. The pin was then adjusted to 6 mm to see the interocclusal space necessary for the restorative materials posteriorly (Fig 3). An RPD was made at increased OVD to use at the first stage of the rehabilitation (Figs 3A, 3B). The removable and temporary fixed restorations were evaluated together (Fig 3C). Diagnostic wax-up was performed at the increased vertical dimension (Fig 4A). This was then followed by the pros-

thetic stage. After preparation of all teeth, autopolymerizing acrylic resin (ALIKE[™]; GC America, Alsip, IL) provisional crowns were fabricated using a vacuum-formed matrix (Drufofen H; Dreve Dentamid GmbH, Unna, Germany). The interim fixed prosthesis was cemented with temporary cement (Temp Bond NE[™]; Kerr) (Fig 4B). In the interim prosthesis, protrusive contact, canine guidance, esthetics, and phonetics were assessed, and 1- and 2-month regular checkups were performed.

This interim prosthesis was used for 3 months as a guide for the definitive oral rehabilitation. The adaptation of the patient to the increased OVD was evaluated. During this period, his functions, muscle sensitivity, mastication, TMJ discomfort, swallowing, speech, and anterior and posterior speaking space were assessed. No muscle tenderness or temporomandibular discomfort was found, and the patient was asymptomatic.

Development in facial esthetics, speech, and mastication demonstrated the patient's tolerance.

Following the evaluation period, final preparation was performed, and impressions were made with a two-step putty-wash technique using condensation silicone impression material (Zetaflow; Zhermack), and casts were poured by using type IV Alston dental hard stone (Ata Yapi Urunleri San. ve Tic. Ltd. Sti, Ankara, Turkey). Provisional crown and occlusal registration materials were used to make an interocclusal record. The working casts were articulated, and the interocclusal centric record was transferred to the articulator (Stratos 200) at the previously determined vertical dimension. Definitive restorations were completed on the model from a base metal alloy (Master-Tec; Ivoclar Vivadent AG, Schaan, Liechtenstein) and porcelain (VITA VM 13; VITA Zahnfabrik, Bad Sackingen, Germany). The maxillary and mandibular teeth were restored with full-mouth metal ceramic restorations. Centric occlusion, protrusive contacts, and canine guidance were assessed in the definitive anterior restoration. The scheme of occlusion was mutually protected articulation (Fig 5). In the maxillary anterior restoration, long centric occlusion was developed to permit freedom in anterior-posterior movement. Anterior plane and esthetics were used as a guide to establish the anterior guidance. Phonetics were assessed using the closest speaking space technique.

Finally the definitive restoration was cemented with temporary cement (Temp Bond NE™). Oral hygiene training and regular checkups were performed. The patient was evaluated for 24 and 48 hours, and occlusal corrections were made. Once the occlusal adjustments, speech, and esthetics seemed satisfactory, all restorations were cemented definitively with zinc polycarboxylate cement (Adhesor® Carbofine; Kerr) (Figs 6A, 6B). Compared with the pretreatment profile (Fig 6C), the post-treatment profile photographs (Fig 6D) showed a significant correction in the facial profile. Following the definitive cementation of all restorations, a protective occlusal splint was manufactured to protect the restorations. The patient was instructed about oral hygiene maintenance. Routine clinical assessments were made after 1 and 4 weeks, 3 and 6 months, and 1 and 2 years with visual and radiographic examinations. Criteria for success included functional harmony, absence of pain, no tension or tiredness in facial and masticatory muscles, and phonetic and esthetic satisfaction. The patient acknowledged having improved function and esthetics and was pleased with the results.

Discussion

Full-mouth rehabilitation is one of the most complex treatment procedures to be managed in dental applications. The aim is not only replacement of the lost tooth structure, but also correction of an improper bite position and restoration of the lost vertical dimension.¹⁴ Attrition, abrasion, erosion, tooth loss,^{8,10,15} and dentoalveolar and skeletal anomalies¹⁶ can be reasons for loss of vertical dimension. In the present report, the etiology of vertical dimension loss was diagnosed as skeletal deep bite followed by tooth loss.

A previous study classified deep bite as one of the most common and difficult malocclusion¹⁷ types to treat in dentistry.¹⁸ Class II deep-bite patients have some common clinical charac-

teristics. The most common is a deep mento-labial sulcus over a prominent chin.¹⁶ Other characteristics could be described as follows: aging effect of poor profile on the patient, pressure of lower incisors on palatal tissue or upper incisors on labial tissue, and improper anterior guidance.¹⁰

Treatment procedures of Class II deep bite are surgical therapy in combination with orthodontic treatment,^{10,12} restorative procedures, and orthodontic therapy followed by restorative procedure.¹⁰ The deep bite is the most difficult case to correct orthodontically, since it often relapses following orthodontic treatment.¹⁹ In the present report, because of the length and difficulty of the treatment procedure, the patient did not prefer surgical-orthodontic treatment. Therefore, correction of dento-facial deformities was to be treated with restorative procedures only. Increasing the OVD has an effect on not only the facial esthetics and the peri-oral areas, but also on the whole face.²⁰ However, a previous study indicated that changing OVD within a range of 2 to 6 mm may not be visually noticeable.²¹ In the present report, OVD increased with full-mouth restoration, and a noticeable facial change was obtained.

Although many OVD-evaluating methods are described in the literature,^{22,23} there is no single absolute scientific method to determine correct OVD.^{4,6} A combination of some is recommended for clinical determination.⁶ In the present report, among the techniques, facial soft tissue contours and assessment of the RVD were used to evaluate the OVD clinically. In addition, the golden rule, profile, contour of the lips, and old photographs were accepted as criteria for evaluating OVD.

A variety of methods are available for increasing vertical dimension.^{4,8-10} Removable or fixed provisional restorations can be used as prosthetic methods for increasing the OVD.⁹ Previous studies suggested using a removable acrylic resin occlusal splint, direct bonded composite resin, or an onlay or interim fixed prosthesis, to obtain an increase in OVD.^{2,8,9} Patient harmony, speech interference, and lack of esthetic assessment are disadvantages of removable occlusal splints.^{4,8,9} Nevertheless, before definitive restoration, the splint should be preferred if the patient has TMD symptoms.⁹ In the present report, the patient had no TMD symptoms. In addition, the removable splint to increase OVD is not suggested for TMD-free patients, since it might create signs and symptoms due to splint wearing rather than OVD increase.² Bachhav and Aras⁴ indicated that an interim prosthesis can be changed in the mouth until the patient is comfortable with his occlusion; however, wear of this interim prosthesis during the evaluation period could make long-term management of OVD difficult. On the other hand, the disadvantages associated with fixed provisional restorations were irreversible tooth preparation and loss of cement seal.⁴ A previous study stated that the fixed method for increasing the OVD is more predictable and practicable to assess the patient function, esthetics, and phonetics.⁹ In addition to this, the major purpose of fixed interim prostheses is to determine the occlusion at the determined OVD.²⁴ Therefore, in the present report, a fixed interim prosthesis was used in the evaluation period to obtain an increase in OVD (Fig 4B). The removable restoration was used only during tooth preparation to confirm the determined vertical dimension (Fig 3B).

In previous reports, however, the time for wearing an interim prosthesis varied; the testing period of interim prostheses is

2 to 6 months.^{3,25,26} In the present report, the patient was carefully analyzed for 3 months to evaluate the adaptation to the determined OVD with a fixed interim prosthesis. In this report, after increasing the OVD, from the classification of the treatment through to the follow-up period,⁹ a medium-term duration (1 month to 2 years) was selected, and the period was identified as 3 months. The process was shorter than other reports, because the patient was asymptomatic during the evaluation period and had a very high native adaptation capacity.

Although increasing OVD is a safe procedure,² if the treatment period has to be extended, multiple complications can occur.²⁷ A previous study stated that problems associated with increasing OVD include joint or muscle pain, instability of altered OVD, impaired muscle activity, and altered phonetics.⁴ Increasing OVD more than 5 mm is rarely indicated,² and the patient can adapt to an increase of OVD of up to 5 mm; however, it is impossible to determine the upper limit.⁹ Moreover, minimizing the increase in OVD is beneficial to avoid complexity of the prosthodontic treatment.² In the present report, OVD increased 5 mm in the anterior region and 3 to 4 mm in the posterior region. In addition, the patient adapted and was not forced to make a correction by creating space (Fig 3A).

The Glossary of Prosthodontic Terms defines *mutually protected articulation* as “an occlusal scheme in which the anterior teeth disengage the posterior teeth in all mandibular excursive movements, and the posterior teeth prevent excessive contact of the anterior teeth in maximum intercuspation.”¹ In lateral excursive movements, the anterior teeth can best dissipate the forces. Because of the amount and direction of the applied forces, posterior contacts in excursions can cause negative effects on the masticatory system.²⁴ Therefore, in the present report, for provisional and definitive restoration, a mutually protected occlusal scheme was used to prevent destruction of the new prosthesis.

Many factors affect restoration choice. All-ceramic restorations have less sufficient mechanical properties than metal-ceramic restorations. This limits their clinical indications.²⁸ A previous study suggested that these materials can predictably achieve esthetic results in the anterior regions. They have traditionally been contraindicated for posterior regions, because of the greater stresses present in these areas.²⁹ One of the most common clinical features observed in the Class II deep-bite patient is tension in the facial and masticatory muscles. Thus, increased masticatory forces occur in anterior and posterior regions. Therefore, metal-ceramic restorations were selected instead of all-ceramic restorations (Figs 6A, 6B). In another study, the use of metal occlusal surfaces was suggested to reduce the chance of porcelain fracture.³ However, in the present patient, it was not applied because of his esthetic demands.

Conclusion

Full-mouth rehabilitation with the creation of OVD with a severe deep bite not only focuses on the esthetics and functional expectations of the patient but also improves the health of the stomatognathic system entirely. Because of some limitations in the method of increasing OVD, the evaluation period, definitive restoration, and maintenance phase have to be considered carefully.

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