Full mouth rehabilitation in a limited restorative space with severely worn teeth — a case report

Abstract
This report describes a patient with severely worn anterior teeth and early loss of posterior teeth from the mandible, resulting in a restricted restorative space. The patient's chief complaints were poor chewing function and esthetic appearance. To create sufficient restorative space and provide an improved appearance, we used a removable appliance to test an increased vertical dimension. After a one-month adaptation period, we began fabrication of a complete maxillary overdenture prosthesis and a Kennedy class I removable partial denture with surveyed crowns in the mandible. During the provisional stage, the patient adapted smoothly, and no muscles or temporomandibular joint related symptoms or signs were noted. Finally, we met the treatment goal of rehabilitation of the chewing function, and a satisfying smiling appearance.

Keywords: vertical dimension increase, worn tooth, limited interocclusal space, full mouth rehabilitation

Introduction
The vertical dimension of occlusion (VDO) is constant throughout an individual's life, and any alteration in this distance will interfere with the physiology of the masticatory system, although many authors assume that patients can adapt to such changes.1, 2 Multiple techniques have been proposed to quantify the VDO, including the use of pre-treatment records, incisor height measurements, phonetic evaluation, patient relaxation, assessment of facial appearance, radiographic evaluation, and neuromuscular evaluation.3 Each of these techniques has proven useful; however, there have been no scientific assessments of the accuracy of these methods.4

In daily clinical practice, patients request prosthetic rehabilitation to restore unstable occlusion resulting from extensive tooth wear and early loss of permanent teeth. However, a limited interocclusal space often creates a challenge for restorative treatment because the space required for restoration is unavailable, and it is probable that the final retention and resistance form will be inadequate. The use of surgical crown lengthening to reposition the gingival tissues and elective devitalization of teeth are frequent methods used for restoration. However, if patients have periodontal disease, crown-lengthening procedures will aggravate any reduction in bony support. A more reliable method is to increase the VDO to provide space for re-
A 61-year-old woman presented to the Shin Kong Wu Ho-Su Memorial Hospital Department of Prosthodontics clinic with chief complaints of poor chewing function and poor esthetic appearance (Fig. 1). The medical history was noncontributory, and a long-span ill-fitting fixed partial denture in the maxilla was restored with tooth numbers 17, 16, 15, 12, 21, 22, 23, 26 as abutments by local dental clinic about 4 to 5 years ago (Fig. 2). There was severe periodontal destruction of these abutment teeth, and the patient had lost her bilateral mandibular teeth a long time before the upper prosthesis was fabricated. Thus, during these 4–5 years, the patient could only perform the chewing function with the anterior teeth, and severe attrition of the anterior teeth in the mandible was present. Occlusal analysis revealed a deep overbite and large overjet of 5 mm and 6 mm respectively (Fig. 3). The freeway space was 2 mm with the mandible at rest. The patient exhibited no signs or symptoms of temporomandibular disorder. Long-term loss of restorative materials, enhance the aesthetic tooth display, rectify anterior teeth relationships, and minimize the need for biologically invasive clinical surgery and elective endodontic treatments.\textsuperscript{4-7} Empirically, some authors report that the VDO is a constant dimension throughout an individual’s life.\textsuperscript{1,2,8} However, some authors argue that the dynamic nature of the stomatognathic system is an adaptation by the masticatory system in response to progressive pathologic changes in tooth substance.\textsuperscript{9-13} However, there is no compelling evidence supporting the pathologic consequences of altering the VDO, and thus, we need intensive prior examination prior to increasing the VDO.

Few studies have reported on the influence of increasing the VDO by fixed or removable appliances. Fixed appliances are more reliable and comfortable for the patient\textsuperscript{14–18}. The most commonly reported symptoms of an altered VDO are grinding and clenching, which have a tendency to resolve within 1 to 2 weeks. Increasing the VDO by use of a removable appliance may result in altered development, and produce symptoms including discomfort from wearing a splint, difficulties with phonetics, and joint and muscle disorders.\textsuperscript{18–21} Approaches using removable appliances present significant complications, and have poor patient compliance.

This report describes a case of severely worn anterior teeth and early loss of posterior teeth in the mandible, which resulted in restricted restorative space. The VDO was increased by use of a removable appliance, which successfully increased the restorative space, and provided both chewing function and improved esthetics, without disturbing the periodontal supporting bone.

**Case Report**

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**Fig.1** The patient had a chief complaint of poor chewing function and unaesthetic appearance.

**Fig.2** Intraorally photography shows a long-span ill-fitting fixed partial denture in maxilla was restored with tooth 17, 16, 15, 12, 21, 22, 23, 26 as abutments by local dental clinic about 4 to 5 years ago. a. Upper arch; b. lower arch

**Fig.3** In occlusal analysis, deep overbite and large overjet about 5 mm and 6 mm respectively, were found.
the posterior mandibular teeth led to supra-eruption of posterior maxillary teeth and an uneven occlusal plane. Radiographic examination revealed generalized horizontal bony destruction and secondary caries in the maxillary molars (Fig. 4). We also noted radiolucency in teeth 31, 32, 33 due to severe attrition and necrosis of dental pulp.

Rehabilitation of the chewing function and acceptable aesthetics were the major treatment goals. Nevertheless, it was difficult to develop a treatment plan that met the patient’s expectations, given the restricted restorative space available. Several treatment options are available for a patient with restricted restorative space; (a) increasing the VDO; (b) surgical crown-lengthening procedures and intentional root canal therapy of mandibular anterior teeth; (c) surgical reduction of tuberosity bone in the maxilla. The agreed treatment plan included fabrication of a complete maxillary overdenture with presentation of teeth 15 and 23 overdenture abutments and fabrication of a Kennedy class I removable partial denture in the mandible including teeth 31, 32, 33, 34, 41, 42, and 43 as surveyed crowns. The patient rejected any implantation therapy, and so increasing the vertical dimension was the most conservative approach to solving the problem of available restorative space. If this plan was not successful, then a surgical method might be indicated.

At the start, the VDO, occlusal plan, and aesthetics of the anterior teeth were determined by a diagnostic wax up. The patient was instructed to relax the masticatory muscles and an occlusal bite splint was delivered with anterior teeth coverage to test an increased vertical dimension of approximately 4 mm (Fig. 5). The patient was told that she should wear the splint during daytime and remove it in the evenings. After one month, the patient was recalled for clinical examination. She reported no temporomandibular joint discomfort; a little muscle tenderness resolved during the first week. The VDO was determined by techniques including assessment of facial appearance and phonetic evaluation. The tone of the facial skin was unchanged, and extraoral improvement of facial tissue appearance was insignificant. Phonetic evaluation found that the lower incisors moved forward to a position nearly directly under, and almost touching, the upper incisors during production of “s” sounds.

According to the examination, we began the restorative treatment by removing the ill-fitting prosthesis, and extracting the “hopeless” teeth. A few weeks later, the interim prosthesis of a complete maxillary overdenture was delivered after clinical try in procedure and occlusal adjustment. The increased vertical dimension was checked and recorded carefully.

Fig. 4 Radiographic examinations showed generalized horizontal bony destruction in maxillary molars and the radiolucency image in tooth 31, 32, 33 with severe attrition.

Fig. 5 We delivered an occlusal bite splint with anterior teeth coverage to test the vertical dimension we need to increase (about 4 mm).

Fig. 6 Few weeks later, interim prosthesis of complete overdenture in maxilla was delivered after clinical try in procedure and occlusal adjustment. The increased vertical dimension was checked and recorded carefully.
measured and compared to that acquired at the start (Fig. 7). There was no significant change in the vertical dimension, suggesting that the VDO was stable. An X-ray radiograph of the temporaromandibular joint confirmed that the joint was still located in the glenoid fossa (Fig. 8). The patient had no complaint of the prosthesis, except that the position of the anterior teeth had changed since the teeth extraction, because of shrinkage of tissue volume. The patient expressed a wish for a more retrusive position of the maxilla anterior teeth.

In the permanent fitting stage, a final impression was acquired, and the interocclusal record and vertical dimension were carefully taken, with reference to the provisional prosthesis-based records. Several appointments were needed to align the anterior teeth of the maxilla denture, to meet the patient’s aesthetic expectations. Finally, the permanent surveyed fixed crown prostheses and the removable prosthesis were delivered for clinical fitting and adjustment (Fig. 9). During the following year, the occlusion and vertical dimension remained stable, and the patient adapted smoothly. The patient expressed satisfaction with the significant improvement in chewing function, denture stability, and excellent appearance.

**Discussion**

Generally, the VDO is constant and does not change throughout an individual’s life.\(^1\,^2,^3\) There are several reported procedures for determination of the VDO, and one commonly employed method is measurement of the freeway space when the mandible is at rest. Niswonger\(^22\) reported that the freeway space was 4/32” (3 mm) in 87% of patients; the remaining 13% varied from 1/32” to 11/32”. Niswonger concluded that as the teeth slowly wear down, the body adapts by making necessary changes in bone and soft tissue to maintain the space. Thompson\(^23\) pointed out the stability of the rest position in normal dentition, but that it may be greater than 10 mm in abnormal dentition patients. However, Atwood\(^24\) consid-
ered that each physiologic process has a range of variability. Thus, it may be true that the interocclusal distance is very often 2–3 mm, but there is a range of variation from one patient to another, and even in the same patient from one time to another. The loss of teeth or wear are potential factors for changes the dynamic nature of the stomatognathic system.5

In this case, we increased the VDO to approximately 4 mm, to meet the restorative material's space requirements. There are no clear objective guidelines to optimizing the VDO to maximize the space available, and that is physiologically acceptable to a patient. According to a systematic review investigating the implications of increasing the VDO, a permanent increase in the vertical dimension from 1 to 5 mm is a safe and reliable procedure, and the associated signs and symptoms are self-limiting with a tendency to resolve within 2 weeks.17 Although it may have been safe to increase the VDO by as much as 5 mm, in this study, we performed the work carefully, delivering the occlusal bite splint before commencing restorative treatment, and observing for 1 month to confirm adaptation by the patient. The interim prostheses in the maxilla and mandible were fitted separately, to ensure that teeth preparation and surgical crown lengthening in the anterior mandible was effective.

This case report describes a full-mouth rehabilitation in a restricted interocclusal space with severely worn teeth and early loss of posterior mandibular teeth. We used an occlusal splint to temporarily increase the VDO and observe the patient's adaptation before any restorative treatment was begun. This approach provided a safe and conservative route to meet the patient's requirement. During the one-year follow up, there were no clinical complications or symptoms, or signs of temporomandibular disorder. We successfully met the treatment goals of rehabilitation of chewing function and improved smiling appearance.

References