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Prosthodontic treatment of an Angle III Class malocclusion: A case report

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Patients with an Angle Class III malocclusion are generally treated by orthodontics with or without orthognathic surgery. A literature search revealed very few articles describing solely the prosthodontic treatment of a Class III malocclusion, as it is rarely used as a treatment modality in these cases. The purpose of this article is to show the effects and benefits of an increase in the vertical dimension of the occlusion (VDO) in patients with a Class III malocclusion. An increase in the VDO causes a clockwise rotation of the mandible, thereby increasing the reverse overjet. This phenomenon allows a prosthodontic treatment of the Class III malocclusion in some patients. Therefore, proper diagnostic procedures, careful planning, and

a simulation of the final appearance by wax-up and mock-up are mandatory when choosing the modality of prosthodontic treatment. A case with a Class III malocclusion, treated solely by prosthodontic means, is presented. The implemented prosthodontic treatment included the correction of the crossbite and the occlusal plane, the reestablishment of the anterior and canine guidance as well as the provision of a stable occlusion and enhanced facial and dental esthetics. It is proposed that an increase of the VDO should be taken into consideration whenever a patient with a Class III malocclusion is prosthodontically treated. (*Quintessence Int* 2017;48:625–631; doi: 10.3290/j.qi.a38705)

Key words: case report, Class III malocclusion, increase of vertical dimension of the occlusion (VDO), fixed prosthodontic treatment

An Angle Class III malocclusion is defined by the mesial position of the mandibular first molars with respect to the maxillary first molars.¹ According to the British Standard Institute of incisor classification, in a Class III malocclusion the mandibular incisor edges lie anterior to the cingulum plateau of the maxillary incisors. The overjet is reduced or reversed.²

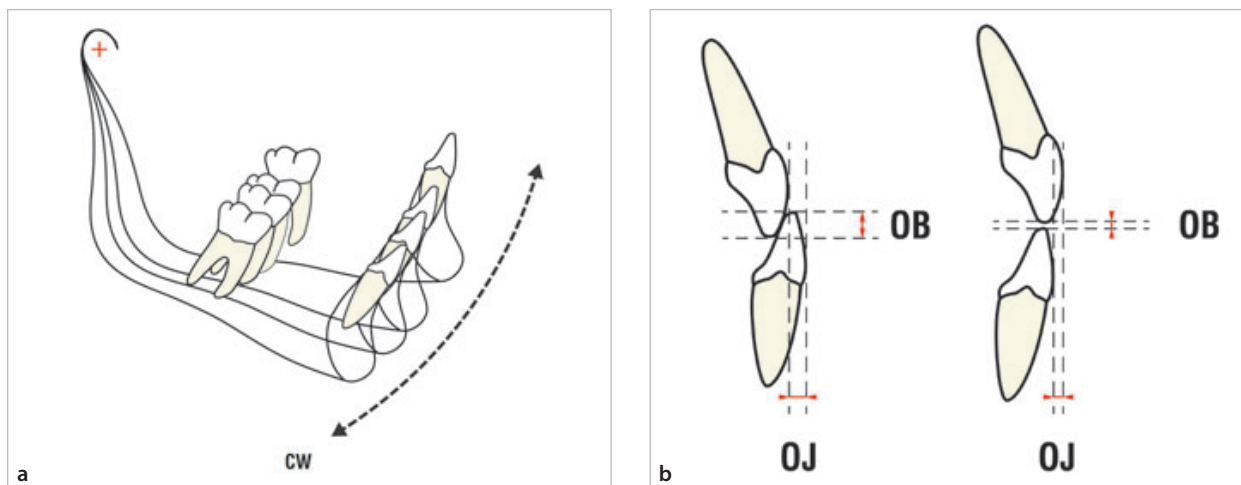
Patients with an Angle Class III malocclusion show a mandibular prognathism and/or maxillary retrognathism, a crossbite is often present, and a reduced or reversed overjet leads to an impaired or absent anterior and canine guidance.³ The chewing function is negatively affected and limited to vertical movements, thus exhibiting a pronounced vertical, or even reversed, chewing pattern.^{4,5} Patients with a Class III malocclusion also show a lower maximum bite force.⁶ Moreover, their esthetic appearance is impaired since the lower facial third is enlarged, the facial profile is concave, and the lower lip is protruded in relation to the upper lip.³

Adults with a Class III malocclusion are normally treated by orthodontic means, with or without orthog-

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Figs 1a and 1b With the increased VDO the mandible moves downwards and dorsally (CW, clockwise rotation). (a) This results in a more distal molar position. (b) Negative overjet (OJ) increases when the overbite (OB) is reduced by an increase in the VDO.

nathic surgery. Nevertheless, the duration of the orthodontic therapy and the invasiveness of the surgery often dissuade them.⁷ One of the therapy options is a prosthodontic approach, as described in the present article. However, a search of the literature revealed only a few publications treating Class III patients exclusively by prosthetic means.^{6,8,9}

Irrespective of the chosen treatment method, the objectives when treating a Class III malocclusion are: correction of the crossbite, creation of a positive overjet and overbite to secure anterior and canine guidance, assertion of a stable occlusion, improvement of the interdental relationship, and improvement of the dental and facial appearance and proportions.

The prosthodontic method for treating a Class III malocclusion may, or in some cases should, include an increase in the vertical dimension of the occlusion (VDO). Increasing the VDO causes the mandible to move downward and dorsally (clockwise rotation), as shown in Fig 1, thereby increasing the overjet.¹⁰ Enlargement of the overjet and subsequent prosthodontic teeth reshaping could be sufficient in some cases of Class III malocclusion to achieve the normal dental relationship and to secure anterior and canine guidance. However, some patients with a Class III malocclusion have an over-proportional lower facial third and an increase of the VDO could further impair their facial proportions; therefore,

careful planning and simulation of the final appearance by wax-up and mock-up are mandatory when choosing the prosthodontics treatment method. Before the treatment, thorough diagnostics should be performed, including clinical examination, lateral cephalogram and panoramic radiograph analyses, intraoral photo-documentation, and study casts mounted in the articulator.

Practical experience and the literature both showed that an increase of the VDO (up to 5 mm) is a safe and predictable procedure. Some negative signs and symptoms were identified, but they were self-limiting.^{11,12} When defining a value for the necessary increase of the VDO, the determining – and at the same time the limiting – factors are facial and dental esthetics, phonetics, and the ability to adapt the closest speaking space to the increased VDO.¹³⁻¹⁵ The physiologic rest position (FRP) could be helpful in determining a proper VDO, but this cannot be the primary method because the distance to subtract from the interocclusal rest space is unknown for any specific patient, and also the FRP is not an objective, repeatable position.¹⁶

An increase of the VDO, whenever indicated, also provides more space for dental materials, and less invasive prosthodontic techniques can be implemented.¹⁷⁻¹⁹ With the development of modern adhesive techniques, porcelain, ceramic, and composite restorations in the posterior part of the jaw can be used safely.²⁰ To help



Figs 2a and 2b Portrait (a) en face and (b) in profile of the patient. Slightly enlarged lower third and protruded lower lip can be observed.

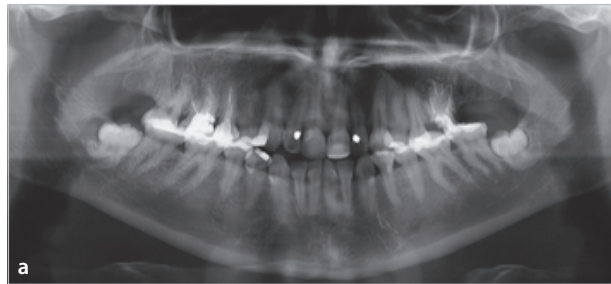
establish anterior guidance, direct composite build-ups of the anterior mandibular teeth may also be beneficial.²¹

The article presents the case of a Class III malocclusion treated exclusively by a prosthodontic method.

CASE PRESENTATION

A young woman in good health wanted an esthetic rehabilitation of her teeth. She objected to orthodontic or surgical treatment options.

A clinical examination revealed a slightly enlarged lower facial third with a concave profile and a protruding lower lip (Fig 2). Orally, an Angle Class III malocclusion was determined, with a reverse overjet of -0.5 mm and an overbite of 0.0 mm, in spite of old buccal composite build-ups of anterior maxillary teeth. In the patient's posterior dental arch, a crossbite was present in the molar area and occlusal surfaces were abraded and eroded up to the dentin. The maxillary right second molar, first molar, second premolar, lateral incisor, and maxillary left lateral incisor, mandibular right canine, and first premolar (teeth 17, 16, 15, 12, 22, 43, and 44 according to FDI notation) exhibited caries; most of the other teeth had composite fillings. The endodontically treated teeth were both the maxillary first molars and the maxillary right second premolar (teeth 15, 16, and 26; Fig 3). Analysis of the face with chin prominence and analysis of the study casts determined an Angle Class III malocclusion; however, further orthodontic diagnostic



Figs 3a to 3d Initial status of patient. (a) Panoramic radiograph of patient at initial presentation. (b) Intraoral view of occlusion. In the anterior mandibular area reverse overjet and no overbite is present. Crossbite was present in the molar area. Composite build-ups are present on the most of the teeth. (c and d) Intraoral view of maxilla and mandible showing abraded and partially restored lateral teeth in both arches.



Table 1 Definitive prosthodontic treatment plan: upper row shows prosthetic restoration, lower row shows teeth according to FDI notation

CO	CO	CO	PV	PV	PV	PV	PV	PV	PV	PV	CO	PFM
17	16	15	14	13	12	11	21	22	23	24	25	26

CO, composite onlay; PFM, porcelain-fused-to-metal crown; PV, porcelain veneer.



Figs 4a and 4b Study casts in the articulator. (a) Study casts show reverse overjet and edge-to-edge position of the incisors. (b) Diagnostic wax-up showing improved teeth relationship with VDO increased by 1.5 mm.



Figs 5a and 5b Minimally invasive preparations were made with the help of a silicon index.

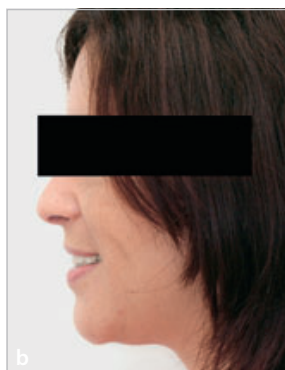
procedures were not pursued, since the patient rejected any orthodontic treatment, therefore no lateral cephalogram was taken. According to the clinical examination of the face and intraoral examination, together with the study cast analysis, Class III malocclusion was diagnosed.

In the pretreatment phase the following procedures were performed: caries removed, a crown-lengthening procedure was performed on the second maxillary right premolar and the first left molar, a gold metal post and core were inserted on the maxillary first left molar, and the retained mandibular third molars were removed.

An analysis of a cast in the articulator revealed that an increase in the VDO by approximately 1.5 mm would increase the overjet from -0.5 mm to +0.2 mm, thus securing an appropriate amount of space for the length of the maxillary incisors. The dental technician received

instructions for the creation of a diagnostic wax-up (Fig 4). A silicone index, containing all the circumjacent structures to enable an accurate positioning in the jaw, was provided. The diagnostic wax-up of the maxillary teeth was transferred into a mock-up using a silicone key and temporary composite material. The patient was happy with the preliminary result and the technical aspects of the prosthetic rehabilitation were planned.

After discussing possible materials and techniques, the patient decided upon porcelain veneers for all her anterior maxillary teeth, including the maxillary first premolars. For the maxillary posterior teeth, starting from the maxillary second premolars, the patient chose more affordable composite onlays. Due to vast tooth-substance loss on the maxillary first left molar, the conventional solution of a metal post and core and



a single crown were chosen (Table 1). To ensure long-term success, the patient decided in favor of a porcelain-fused-to-metal (PFM) crown, as opposed to a more contemporary and esthetic solution of zirconia crowns.^{22,23} In the mandible, no treatment was needed.

The prosthetic treatment began with the posterior teeth prepared according to a minimally invasive technique. The maxillary first left molar was prepared for a crown. Subsequently, the temporary onlays and the crown were produced using a silicone key impression made from the wax-up.

Temporary restorations provided stable support for the new height of the VDO, which enabled a better overview of the actual need for the removal of the incisal tooth substance on the anterior maxillary teeth. In addition, a specially adapted silicone key, cut horizontally several times (Fig 5), helped to form a minimally invasive preparation.²⁴ In this way, the preparation remained mainly in the enamel, which secures a strong bond to the porcelain and achieves good, long-term success during adhesive cementation.²⁵⁻²⁷ An impression was made of the maxilla and a facebow registration was taken. A new interocclusal relationship was registered using an anterior jig made with the help of one temporary onlay inserted on each side of the maxilla. The provisional veneers made according to the diagnostic wax-up were fastened with a small amount of flowable composite.

In the next session, the porcelain veneers, the composite onlays and the metal core were tried-in. The onlays (Gradia, GC) were adhesively cemented, while the porcelain was sent for refinement.

Figs 6a to 6e The patient's facial and dental status after the completion of treatment. (a) Portrait of the patient en face and (b) in profile after the treatment. The patient's profile is improved due to enhanced upper lip support. (c and d) Intraoral views after rehabilitation show positive overjet and overbite secured by porcelain veneers, composite onlays, and porcelain-fused-to-metal crown. (e) Porcelain veneers secured proper overjet and overbite.

Finally, eight porcelain veneers (IPS e.max Press, Ivoclar Vivadent) were adhesively bonded (Variolink II, Ivoclar Vivadent). Following the porcelain try-in, the PFM crown on the maxillary first left molar was also cemented (Fig 6).



Figs 7a and 7b Smile esthetics are significantly improved. (a) Thin upper lip and poor dental esthetics before treatment. (b) Enhanced support of the upper lip improved smile esthetics after the treatment.

The prosthodontic rehabilitation of the Class III malocclusion resulted in the establishment of a stable occlusion, as well as anterior and canine guidance. A positive overjet and overbite were achieved, providing the patient with a more harmonious smile (Fig 7). Increasing the VDO slightly improved the relationship between the canines and the first molars, thus improving the Angle III Class malocclusion.

The primary goals for the prosthodontic treatment in this case were an improvement of the tooth form, the appearance of the lower facial third, and the achievement of anterior and canine guidance. The patient was satisfied with the result.

The patient entered regular maintenance program, and a last follow-up 2 years after the delivery of restorations revealed no changes of dental and periodontal status.

DISCUSSION

In this case report a prosthetic approach to treating a Class III malocclusion based on an increase of the VDO was proposed. Nevertheless, treating a patient with a Class III malocclusion exclusively by prosthodontic means is not a common method. In the literature only three cases have been presented.^{6,8,9} All of them used an increase of the VDO as the primary method to increase the overjet with a subsequent reshaping of clinical crowns to establish the anterior guidance.

The treatment of choice for a Class III malocclusion is orthodontics with or without orthognathic surgery.

This provides excellent results and preserves the structure of the tooth. Prosthetic treatment should not be considered as the primary method for treating a Class III malocclusion. It should not be proposed unless an objective indication of prosthetic treatment already exists or a patient rejects other treatment options.

When a patient with a Class III malocclusion requires prosthodontic treatment, an increase of the VDO should be taken into consideration. Increasing the VDO improves the interdental relationship, and together with the prosthodontic reshaping of the teeth, anterior guidance can be established. In this way the masticatory function is clearly improved and better support for the upper lip is secured.⁶

However, further enlargement of the accentuated lower facial third may outweigh the esthetic and functional benefits of the proposed treatment. Therefore, before any irreversible treatment steps are taken, a diagnostic wax-up and mock-up must be performed to evaluate the outcome of the increased VDO on the facial esthetics.

CONCLUSION

Prosthodontic treatment, whenever indicated, of Class III malocclusion patients through an increase of the VDO and reshaping of the crowns may help improve the interdental relationship, masticatory function, and facial esthetics. Anterior guidance, better lip support, and more harmonious appearance of the smile should meet most of the patient's expectations.



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