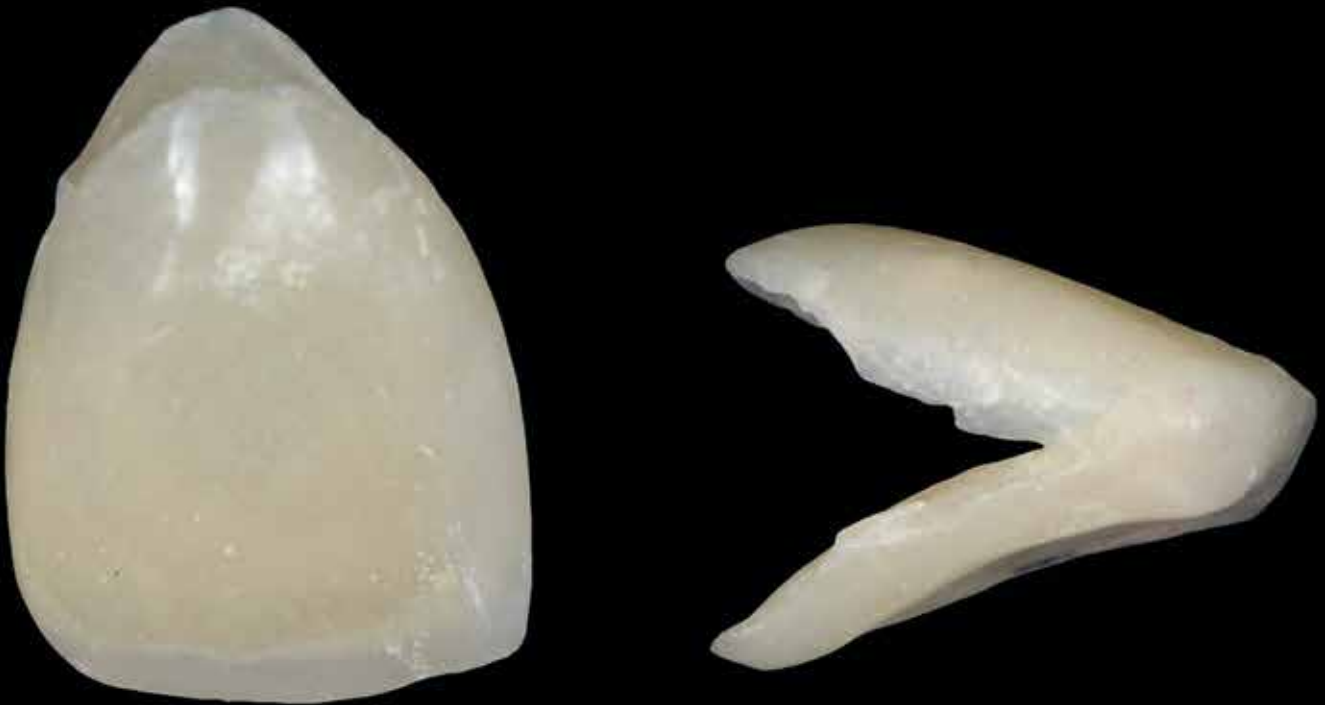


# THE ESTHETIC JIG:

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## An Original Dental Appliance for Esthetic Occlusal Vertical Dimension Rehabilitation

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## Abstract

A patient's vertical dimension measurement is an important factor for the clinician to consider when planning an oral rehabilitation. Establishing the correct occlusal vertical dimension (OVD) is dependent upon dental and facial analysis, the latter of which should include measurements of facial anatomic points and evaluation of facial ratios. However, a challenge dentists can encounter is transferring planned measurements to the patient's mouth. This article describes an interocclusal device, called the esthetic jig, that is created according to customized parameters for each patient that can help dentists to properly achieve the correct OVD.

**Keywords:** vertical dimension, occlusal vertical dimension, dental occlusion, dental rehabilitation, composite restorations



## Introduction

Vertical dimension has been defined as the distance between two selected anatomic points.<sup>1</sup> When the mandibular teeth occlude with the maxillary teeth, the vertical dimension is defined as the occlusal vertical dimension (OVD). Treatment planning an ideal oral rehabilitation should account not only for the anatomic shape, dimension, and position of the teeth, but also the OVD. These smile components are interconnected and inseparable in the manner in which they strongly influence each other. OVD for dentate individuals is determined primarily by the remaining dentition; hence, loss of tooth structure might influence the OVD, and a loss of OVD can significantly affect patient function, comfort, and esthetics.<sup>2</sup> As soon as the dentist diagnoses an inadequate OVD in a patient, the ideal dimension for that patient should be established.<sup>3,4</sup>

## Increasing OVD

From a clinical perspective, increasing OVD has been reported to facilitate the treatment of patients presenting with generalized and complex dental abnormalities such as generalized tooth wear and significant occlusal irregularities.<sup>5-8</sup> However, considerable debate remains in the literature about treatment modalities used to increase OVD. Some authors have assumed that OVD is constant throughout an individual's life and any alteration of OVD will subsequently interfere with masticatory system physiology and the patient's ability to adapt.<sup>9,10</sup> Reported consequences of increasing OVD are masticatory muscle, occlusal force elevation, bruxism, and temporomandibular disorders.<sup>2,9,10</sup> Conversely, other authors have reported that such symptoms are transitory.<sup>11-14</sup> Although evidence regarding the implications of increasing OVD is still lacking, rehabilitative procedures involving the increase of OVD should be approached with caution, and appliances that could facilitate its execution are always welcome.<sup>15-23</sup>

## Lucia Jig

For example, the Lucia jig—which is considered a neuromuscular reprogramming device—is fabricated at the maxillary central incisors and has been used in dental practice for several purposes. These have included disoccluding the teeth and, consequently, deprogramming the neuromuscular activity pattern; preventing occlusal interferences; enabling better manipulation of the mandible; and allowing evaluation of changes and disorders in dental occlusion.<sup>24</sup> However, this device enables dentists only to evaluate dental occlusion, without providing information about the ideal dental esthetics to be achieved or allowing the use of esthetic references when determining the amount of OVD increase.<sup>25,26</sup>

## Esthetic Jig

Alternatively, the esthetic jig is an interocclusal device similar to a provisional central incisor crown restoration that is fabricated from acrylic resin directly over the maxillary and/or mandibular central incisor, or indirectly on a gypsum cast model.

“...rehabilitative procedures involving the increase of OVD should be approached with caution, and appliances that could facilitate its execution are always welcome.”

Because the esthetic jig is used to determine a patient's current OVD measurements, it is placed over the existing tooth form (i.e., no dental preparation or removal of tooth structure is necessary), making it a practical and simple device. Therefore, composite resin should not be used in its fabrication due to the material's lack of flexibility and susceptibility to fractures during insertion and removal.

Several principles guide the fabrication of an esthetic jig, as follows:

**Dimensions:** The esthetic jig's width and length are based on facial measurements. Its width is established by dividing the interpupillary distance by 6.6. Because the relationship between the interpupillary distance and the mesiodistal width of maxillary central incisors is stable throughout life beginning at age 4, it is an excellent reference. It also has been reported that in 95% of cases, the maxillary central incisor width could be obtained by dividing the interpupillary distance by 6.6.<sup>27</sup>

In the author's daily routine practice, the average measurement ranges from 8.3 to 8.9 mm for women, and from 8.6 to 9.2 mm for men. Although not exactly the same, they fall within the averages found in the literature, including one study of 100 North American patients that measured the interpupillary distance from the center of the left pupil to the center of the right pupil, along with the width of central incisors at their widest (Table 1).<sup>27</sup>

**Table 1.** Average Interpupillary Distances and Central Incisor Widths

	Interpupillary Distance	Central Incisor Width
White male	57.87	8.92 mm
White female	56.51 mm	8.52 mm
Black male	59.39 mm	9.13 mm
Black female	62.86 mm	9.02 mm

After determining the patient's ideal central incisor width according to facial analysis, the correct central incisor length for the esthetic jig is then established. This can be determined by multiplying the width by 1.25; however, others have advocated using the width ratio multiplied by 1.33.<sup>28</sup>

**Position:** The ideal inclination of the buccal (i.e., vestibular) aspect of the esthetic jig should be based on a lateral (i.e., profile) smile evaluation. One study found that the average right central incisor buccal surface inclination is 6.48°, with a standard deviation (SD) of ± 3.99; and the average left central incisor buccal surface inclination is 6.30°, SD ± 3.90.<sup>29</sup> The inclination should result in the incisal edge falling between the dry-wet vermilion of the lower lip.

Additionally, the amount of the esthetic jig's incisal display with an open upper lip (i.e., parted lips) should approximate an average of 2 mm for males and 3.4 mm for females,<sup>30</sup> a difference explained by the fact that women's lips, in general, are shorter than men's. If the esthetic jig display exceeds these measurements, dentists might add acrylic resin to the incisal edge, keeping in mind the maximum length in relation to the width, as determined by multiplying the width by 1.33. However, before multiplying the width by 1.25 or 1.33, it is also important to consider the trespass.<sup>25,26</sup>

**Palatal surface anatomy:** This aspect of the esthetic jig should incorporate all anatomic points (e.g., proximal crest, cingulum, incisal edge, and palatal concavity) and their respective characteristics. If a proper increase of OVD is not achieved with a maxillary esthetic jig that demonstrates a normal, concave palatal anatomy, the dentist absolutely should not add more acrylic resin; the esthetic jig should be left with little or no concavity and, in such cases, an esthetic jig also should be placed on the lower central incisor to antagonize the maxillary esthetic jig. This may reveal the need to increase the incisal edges of the anterior teeth to achieve the OVD necessary for rehabilitation.

**Finishing and evaluating:** After the esthetic jig is fabricated, it should be polished so that it does not interfere with mandibular and labial movements. It should then be tried in the patient's mouth, and any necessary adjustments made. In particular, several aspects should be evaluated and tested (Table 2).

**Table 2.** Esthetic Jig Aspects to be Evaluated and Tested

Aspect	Ideal
shape	Similar to a natural central incisor.
incisal exposure at rest	2 mm for males; 3.4 mm for females.
buccal surface inclination	Approximately 6.4° when the patient is smiling and observed from the profile view.
length	Esthetic jig length should not be excessive; when the patient is smiling, the incisal edge of the jig should not produce pressure on the upper edge of the lower lip.
trespass	At least 2 mm to produce a mutually protective occlusion and a maximum of 4 mm to facilitate protrusive movements.
incisal dominance	When the patient is smiling and observed from the frontal view, the incisal aspect of the jig should be at a lower horizontal level than the other maxillary teeth.
at centric occlusion	The patient should be asked to occlude the teeth, after which the dentist should evaluate the resulting available interocclusal space between the posterior teeth, which will receive restorations in the future.
facial length and width	Verify that the face is not extremely long. For reference, use the length from the trichion (i.e., hairline) to the base of the chin minus 30%, which equals the female facial width, or minus 35%, which equals the male facial width. <sup>21</sup>
passive labial seal	The patient should be able to passively close the lips.
phonetic test	Movement of the lips and tongue during speech should be observed. The inclination should result in the incisal edge falling between the dry-wet vermilion line of the lower lip.



**Figure 1:** Pretreatment maxillary occlusal view of the patient's anterior and posterior teeth showing wear due to bruxism and GERD.



**Figure 2:** Pretreatment mandibular occlusal view.

## Case Presentation

### Patient Complaint and History

A 37-year-old man presented for treatment with the chief complaint of esthetic deficiency of his anterior maxillary teeth. His posterior teeth were also worn due to parafunction and gastroesophageal reflux disease (GERD) (Figs 1 & 2), both of which caused a loss of OVD.

### Treatment

After the initial evaluation, the following treatment plan was executed, demonstrating the use(s) of the esthetic jig.

1. Referral to a gastroenterologist to treat his GERD and prevent future harm.
2. Preoperative botulinum toxin injection in the masseter and temporalis muscles to decrease their contraction strength and muscle tone at rest (Fig 3). It was used preoperatively as supporting therapy to enable dental rehabilitation, which included restoration of OVD, by diminishing the power of the masseter and temporalis muscles in this case of severe bruxism. In this patient, these muscles exhibited hypertrophy by their dimensions, which may contribute to enamel cracks, dental attrition, and bone exostoses in some patients. The bigonial distance almost equaled the bizygomatic distance; it should correspond to 75% of the zygomatic width.<sup>31</sup>
3. Fabrication of the esthetic jig to help reestablish OVD (Fig 4). The esthetic jig was placed over the patient's central incisors, without any cement or adhesive (Figs 5 & 6). Since the proximal surfaces of esthetic jigs are not closed with acrylic, they are flexible; they extend beyond

the prosthetic equator of the central incisor during insertion, stabilizing it on the tooth during the rehabilitation process.

The patient's smile was observed from the frontal view to determine whether restorative materials should be added to his mandibular posterior teeth, maxillary posterior teeth, or both to facilitate anterior guidance and function and avoid occlusal contact of posterior teeth during excursive movements (Figs 7 & 8). This decision should primarily be based on the principle of incisal dominance of the central incisors compared to the other maxillary teeth.<sup>32</sup> This principle, which is rooted in tooth function, asserts that maxillary anterior teeth should fall lower than posterior teeth to facilitate grabbing and biting food.

Additionally, it is esthetically unpleasant to observe maxillary posterior teeth at a lower level than anterior maxillary teeth (e.g., cases of maxillary posterior teeth extrusion). It also is important for the incisal aspect of maxillary incisors to fall at a lower horizontal level than the remaining maxillary teeth as the alignment follows the upper edge of the lower lip.

For these reasons, adding restorative material to the occlusal surface of mandibular posterior teeth and not to the maxillary posterior is preferred. The addition of restorative material to the occlusal surface of the maxillary posterior teeth to increase OVD would also increase clinical crown interferences, as well as contradict the dominance principle of anterior teeth over posterior.



**Figure 3:** Botulinum toxin was injected in the masseter and temporalis muscles to decrease their strength during parafunction, as well as muscle shortening.



**Figure 4:** Buccal, palatal, and proximal views of the maxillary and mandibular central incisor esthetic jigs fabricated for the patient.



**Figure 5:** The esthetic jigs were placed on the central incisors without cement or adhesives to enable a functional evaluation.



**Figure 6:** The interocclusal space to be restored was evaluated with the patient in central occlusion.



**Figure 7:** The esthetic evaluation included observation of the amount of the esthetic jig's clinical crown display with open lips.



**Figure 8:** The esthetic evaluation also included evaluation of the jig's initial position jig in relation to the upper vermilion of the lower lip.

4. Restorative treatment that included placement of no-preparation direct composite for the final restorations in both anterior and posterior teeth. One advantage of the esthetic jig technique is that the dentist can work independently from the technician. Additionally, placing composite restorations affords the dentist an opportunity to perform artistic work in rebuilding esthetics and function, without preparing or removing healthy enamel.

According to the restorative treatment approach, the esthetic jig can be used in two different ways. For direct restorations created on the selected posterior teeth, the esthetic jig is used to verify the height of each restoration and also occlusal function, as well as guide adjustments according to its indexed anterior guidance. When placed on a gypsum model mounted in an articulator, the esthetic jig serves the same purposes for indirect restorations.

Restoring the selected posterior teeth establishes a new OVD (Figs 9-12). The next step is to again place the esthetic jig on a central incisor, where it will serve as a reference during the rehabilitation of the contralateral teeth (Fig 13).

This rehabilitation can be performed with direct composite resins in the mouth, or indirectly over the model (e.g., to duplicate the wax-up of the contralateral tooth) (Fig 14). Hence, it will guide both posterior and anterior rehabilitation.

In this case, the ideal length of the esthetic jig (i.e., central incisor) was measured (11.50 mm) to guide composite placement on the gypsum model (Figs 15 & 16). This enabled planning of composite layers directly on the cast, eliminating the waxing stage (Fig 17).

The dentin composite layer restoring the mamelons ended 0.5 mm from the ideal final length (Fig 18), ensuring space for composite layers corresponding to the translucent halo (i.e., 0.3 mm thick) and opaque halo (i.e., 0.2 mm thick). A blue effect composite was added to the incisal to simulate the opalescent halo, in addition to brown stain at the cervical area and ochre color over the mamelons (Fig 19). Opaque halo effects and white stain were then applied over the blue effect composite layer (Fig 20). A final layer of enamel composite resin was then applied (Fig 21).



**Figures 9 & 10:** Direct restorations were placed in the posterior teeth using a metal matrix to fabricate proximal surfaces. This was essential to avoid narrowing of occlusal surfaces.



**Figure 11:** A dentin layer of direct composite was placed.



**Figure 12:** A final layer of direct composite resin was placed to complete the posterior restorations.



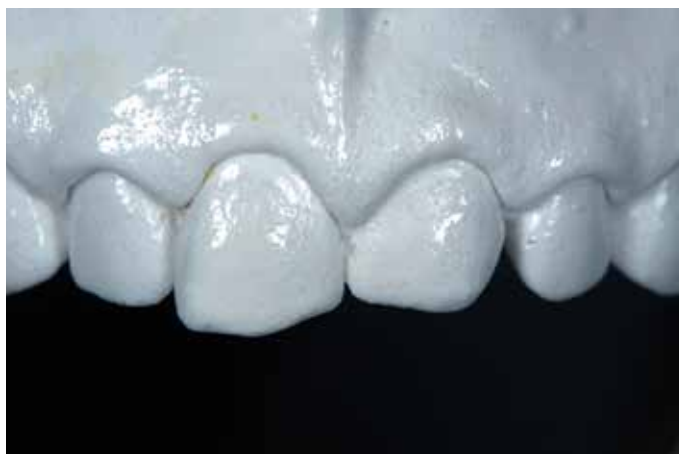
**Figure 13:** The posterior teeth intercuspation after posterior restoration placement and adjustment, resulting in simultaneous posterior teeth contact and palatal surface contact of the esthetic jig.



**Figure 14:** To begin fabricating the maxillary anterior restorations, the case was mounted on a semi-adjustable articulator (optional).



**Figure 15:** The length of the esthetic jig was measured to guide composite placement on the gypsum model.



**Figure 16:** The isolated gypsum model with two layers of super glue.



**Figure 17:** With the ideal length of central incisors (11.50 mm) measured in the esthetic jig, it was possible to plan layers of composite directly on the cast.



**Figure 18:** The dentin composite layer restoring the mamelons should end 0.5 mm from the ideal final length.





**Figure 19:** A blue effect composite was added to the incisal, as well as brown stain at the cervical and ochre color over the mamelons.



**Figure 20:** Opaque halo effects and white stain were applied over the blue effect composite layer.



**Figure 21:** A final layer of enamel composite was placed.

“Because the esthetic jig is used to determine a patient’s current OVD measurements, it is placed over the existing tooth form (i.e., no dental preparation or removal of tooth structure is necessary)...”

Because excess composite may be incorporated into the restoration, requiring adaptation and slight contour corrections, the restoration would only be finished and polished after cementation, which was accomplished using a dental resin (Fig 22). Additionally, finishing and polishing prior to cementation could inhibit the resin cement from achieving complete adhesion.

After cementation, the composite restorations were finished intraorally (Fig 23). A disk was used to simultaneously touch up and adjust the mesial portion of the buccal surfaces (Fig 24).

Once the restorations were complete, the final anterior guidance outcome of the anterior maxillary teeth (e.g., palatal surface) and incisal of the mandibular anterior teeth were compared to the initial gypsum model, which was cut using a model trimmer to evaluate anterior guidance (Figs 25 & 26). At rest, the patient displayed more of his central incisors following rehabilitation (Fig 27), and the direct composite restorations were successful in increasing his OVD (Figs 28 & 29).

5. Fabrication and delivery of a nightguard.



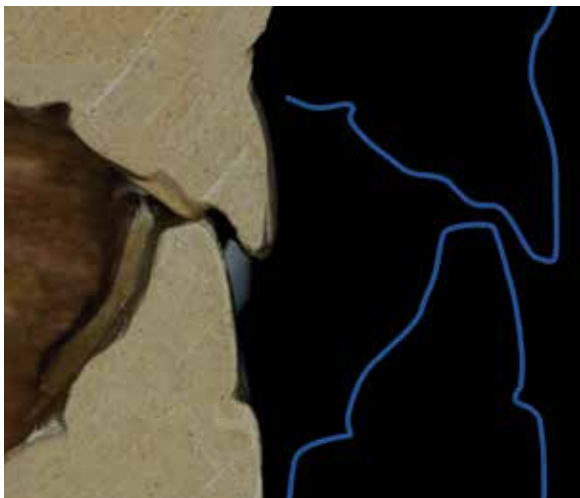
**Figure 22:** The composite restoration was cemented using a dental resin.



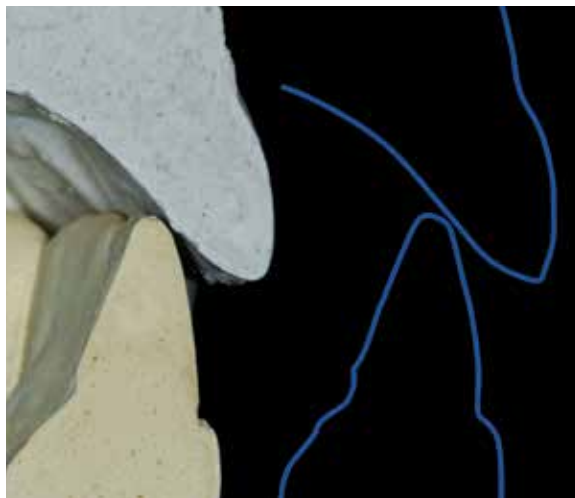
**Figure 23:** The restoration was finished intraorally.



**Figure 24:** View of the final result after polishing.



**Figure 25:** View of the initial gypsum model that was cut using a model trimmer to evaluate anterior guidance.



**Figure 26:** Final anterior guidance outcome after direct restoration of the anterior maxillary teeth (e.g., palatal surface) and incisal of the mandibular.



**Figure 27:** Note the amount of central incisor display demonstrated by the final restorations when the patient is at rest.



**Figure 28:** Postoperative retracted view of the direct composite restorations to increase OVD.



**Figure 29:** Postoperative close-up view of the patient's restored smile.

## Summary

The diagnosis and rehabilitation of patients with a loss of OVD are complex procedures for dentists, partly because this vertical dimension is often defined in random ways. Although employing a Lucia jig has been useful and well described in the literature, it provides few references for establishing a new OVD. However, an easily reproduced guide such as the esthetic jig might facilitate the OVD restorative process and contribute to satisfactory results. Fabricated from an acrylic material based on a combination of interdependent facial, esthetic, functional, and dental references, the device enables dentists to determine the anatomy, dimensions, and position of restorations created during treatment. As a result, it can contribute to a successful oral rehabilitation when reestablishing a patient's OVD is required.

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Dr. Flavio owns a practice in Goiania, Brazil.

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