

Oral rehabilitation in worn dentitions: the importance of occlusion and adhesion

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Abstract: Severe tooth wear treatments demand minimally invasive restorative procedures. The aim of this article was to present and discuss a clinical case of an oral rehabilitation with occlusal vertical dimension (OVD) management and adhesive procedures

achieving satisfactory aesthetics and adequate stomatognathic function. Provisional OVD augmentation with composites, anterior “full veneers” and posterior partial restorations were utilized. Comprehensive planning and the correct treatment indication and execution

achieved a satisfactory result, regarding both aesthetics and function, allowing a less invasive approach in comparison to previously common restorative treatments. **Keywords:** Vertical dimension of occlusion. Oral rehabilitation. Dental ceramic. Dental veneers.

INTRODUCTION

Cases of dentition affected by severe wear are increasingly common in the population and have a new horizon of treatment possibilities with the evolution of Adhesive Dentistry and ceramic materials rich in silica.¹⁻⁹ Partial posterior restorations and ceramic laminates have been demonstrating high rates of success, and have been incorporated into the arsenal of the rehabilitator's alternatives.^{2,10-12} Thus, there is a significant decrease in the need for wearing healthy dental structure and even in the indication of endodontic treatments with prosthetic purposes.¹³

A functional and aesthetic protocol for full mouth rehabilitations requires a well-defined diagnosis, prognosis and treatment plan.¹⁴ The objectives of rehabilitative therapy for wear consist in restoring a proper dental and maxillomandibular relationship, essential for occlusal harmony, with the articulation in centric relation (CR), mutually protected occlusion and without the presence of deflective contacts or interferences, as well as reducing hypersensitivity and improving aesthetics as a whole.¹³⁻¹⁴

According to Fradeani et al,¹³ therapy with minimally invasive prosthetic procedures for the rehabilitation of worn dentitions is based on four key points: 1) vertical dimension occlusion increase (VDO), 2) minimally invasive preparations, 3) posterior monolithic restorations in lithium disilicate; and 4) adhesive cementation. In this way, it is possible to avoid wear of dental structure and to restore occlusal harmony, besides interrupting the progression of tooth wear.

Thus, the objective of the present study is to report the clinical sequence of an oral rehabilitation in worn dentition, with the provisional increase of VDO in composite resin and sectorial finishing with ceramic restorations in lithium disilicate cemented in adhesive form.

CLINICAL CASE REPORT

A 55-year-old male patient sought treatment claiming dissatisfaction with the aesthetic appearance of his smile and perception of progressing dental wear. In the extraoral aspect, aesthetic disharmony, misaligned incisal edges (Fig 1A) and non-exposure of upper and lower teeth when at rest (Fig 1B) were observed.

At the wax-up examination (Fig 2), disharmony of the curve of Spee, wear, fractures and inappropriate relation of the anterior sextants were evidenced. The wear of the palatal face showed dentin exposure (Fig 3).

In the occlusal images (Fig 4), previous restorations and absence of four premolars were noted, contributing to the pronounced curve of Spee.



Figure 1: Initial appearance.



Figure 2: Initial intraoral aspect in occlusion (A), protrusion (B) and mouth ajar (C).



Figure 3: Palatine wear.

The first step of the treatment involved neuromuscular adequacy, or deprogramming, where an acrylic occlusal plate free of edentations was used, allowing disocclusion without interference (Fig 5). After a period of 15 days, a jig was made for repositioning and maxilomandibular registration in CR (Fig 6A) taken. The interocclusal space achieved with the jig was adjusted and tested phonetically (test of Silverman), in addition to Willis compass measures.

The interocclusal distance obtained with the jig provided sufficient space for an additive rehabilitation project, restoring the harmony of occlusal curves and anterior and posterior contacts (Fig 6B). The posterior interocclusal record was finalized (Fig 7). The gypsum models were mounted in a semi-adjustable articulator (SAA), the upper one with a facial bow and the lower one with the CR records (Fig 8). The diagnostic wax-up was performed by restoring ideal contacts, anterior guides and occlusal curves, besides improving shape, relative dimensions and alignment of anterior teeth (Fig 9).

Due to the more pronounced curve of Spee, the option was to increase the VDO provisionally in the lower arch in an adhesive form with heated composite resin. A transparent addition silicone (Elite Transparent, Zhermack, Badia Polesine, Italy) was accommodated on the lower wax-up. After curing and finishing, a matrix that faithfully copied the details of the wax-up was obtained, translucent enough to allow light curing (Fig 10). The lower teeth were etched with 37% phosphoric acid and adhesive system (Single Bond 2, 3M-ESPE, Saint Paul, USA) on the occlusal, buccal (above the prosthetic equator) and lingual (idem) aspects, and the anterior teeth in the buccal-incisal surfaces (Fig 11A to 11C).

After curing the adhesive, the transparent matrix was loaded with composite resin heated to approximately 70° C (Charisma Classic shade A2, Kulzer, Hanau, Germany) to increase its fluidity and

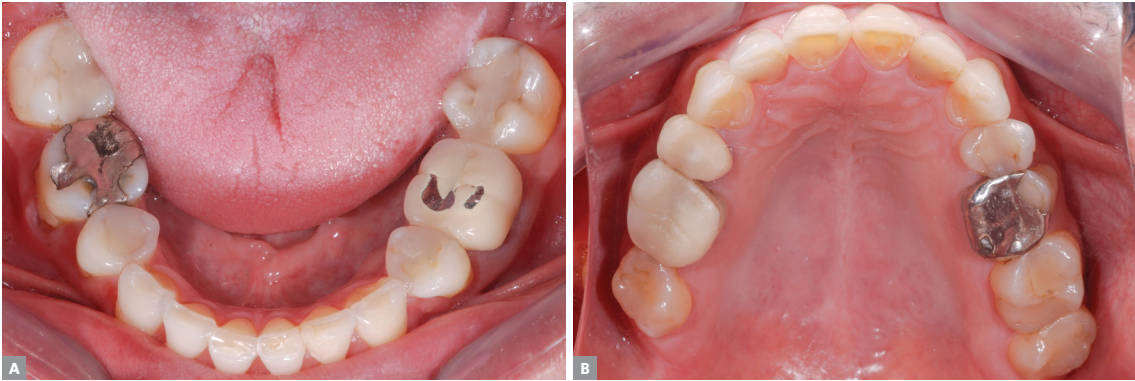


Figure 4: Lower (A) and upper (B) occlusal aspects .



Figure 5: Interocclusal plate adjusted without edentations.

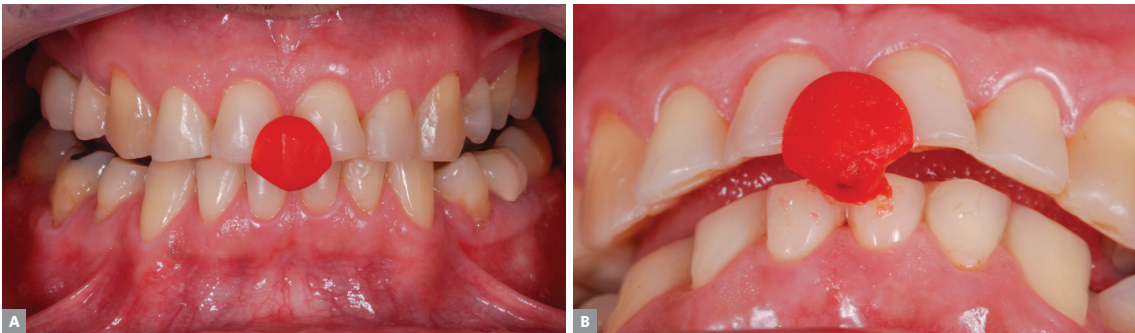


Figure 6: A) *Jig* for registration in CR and new VDO. B) Space achieved.



Figure 7: Complementation of the registration in the posterior region.

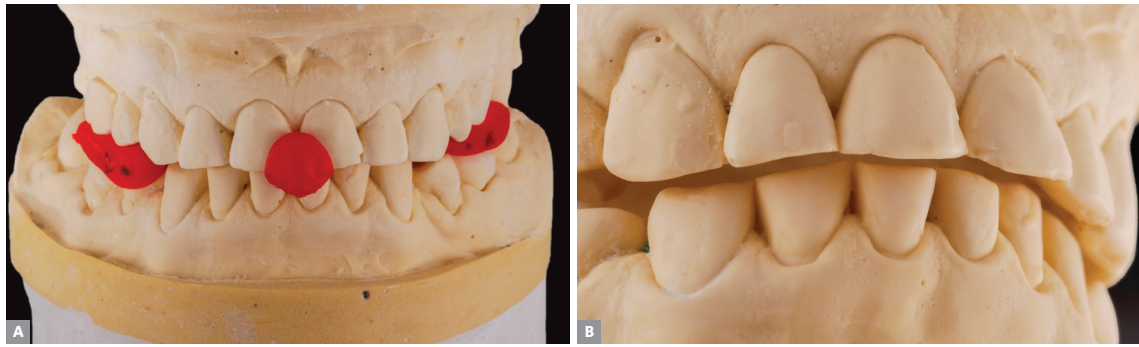


Figure 8: Models assembled in SAA.



Figure 9: Diagnostic wax-up.

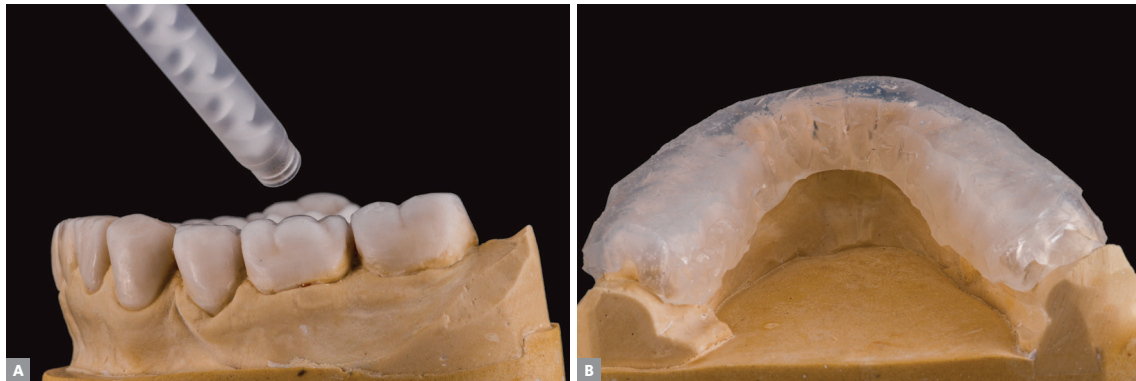


Figure 10: A) Making the transparent matrix. B) Matrix in clear silicone finished.

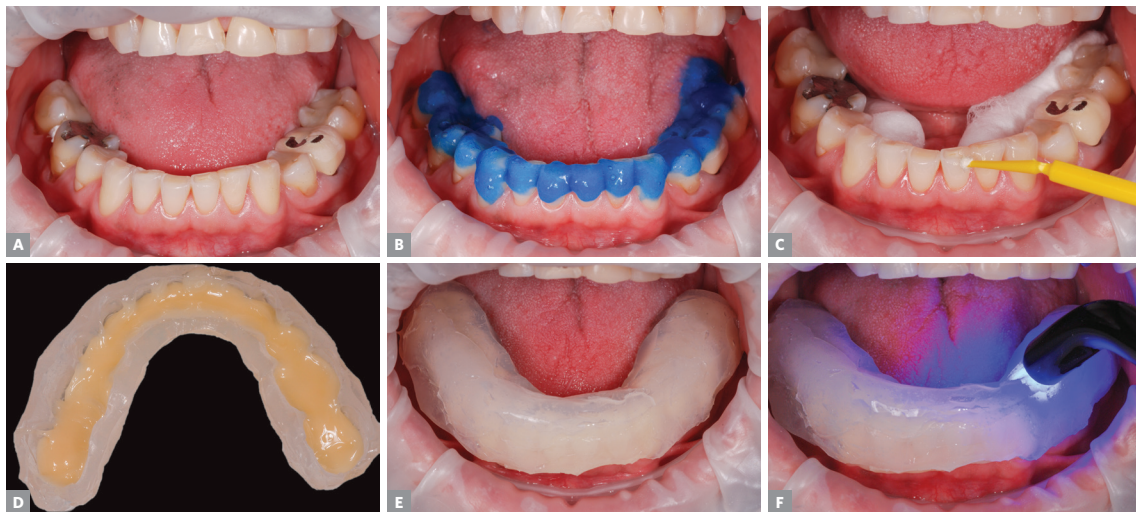


Figure 11: Fabrication of mock-up adhered to provisional increase of VDO. Removal (A), acid etching (B), application of adhesive system (C). Matrix loaded with heated composite resin (D), taken in position (E) and light-cured (F).

flow (Fig 11D). The matrix was positioned until total adaptation (Fig 11E), and each tooth was light cured through the matrix, for 40 seconds (Fig 11F). The matrix was removed and each tooth received direct light curing for another 40 seconds. After excesses removal, finishing, occlusal adjustment and polishing, the new maxillomandibular relation and provisional VDO were obtained, as well as the cor-

rect alignment of the lower incisal border with the lower lip line at rest (Fig 12). Subsequent weekly appointments were scheduled for specific occlusal adjustments and follow-up. After two months for the adaptation of the stomatognathic system, the treatment continued.

With the new VDO tested, sequentially adjusted and clinically approved, the sectorized removal



Figure 12: Appearance of resin after finishing.

phase of the composite resin started for ceramic finishing. The teeth # 45, # 46, # 35 and # 36 were selected for resin removal and provisionalization according to the new occlusal pattern (Fig 13).

At that time, all the old restorations (ceramics, resins and amalgams) were totally removed and all exposed dentin tissue submitted to immediate dentin sealing (IDS) with a self-etching adhesive system (Clearfil SE Bond, Kuraray, Tokyo, Japan), followed by the application of a flow-type resin (Tetric N Flow, Ivoclar Vivadent, Schaan, Liechtenstein) through the Resin Coating technique. The partial posterior preparations were refined with fine-grained diamond burs and Arkansas burs in a multiplier handpiece (Fig 14).

The pre-existing metal retainer in element # 36 was maintained due to the risk of root fracture in its removal, and this was the only conventional total crown preparation (Fig 15). Occlusal stability was maintained by the anterior elements and teeth # 37 and # 47, facilitating the register and provisionalization steps.

After molding and obtaining working models, PMMA structures were designed and milled in a CAD-CAM system for the marginal adaptation and inter-occlusal registration. The structures were adapted to the preparations and a precision acrylic resin (Pattern Resin, GC America Inc., Alsip, Illinois, USA) was placed on the structures for registration against the opposing teeth (Fig 16).

104

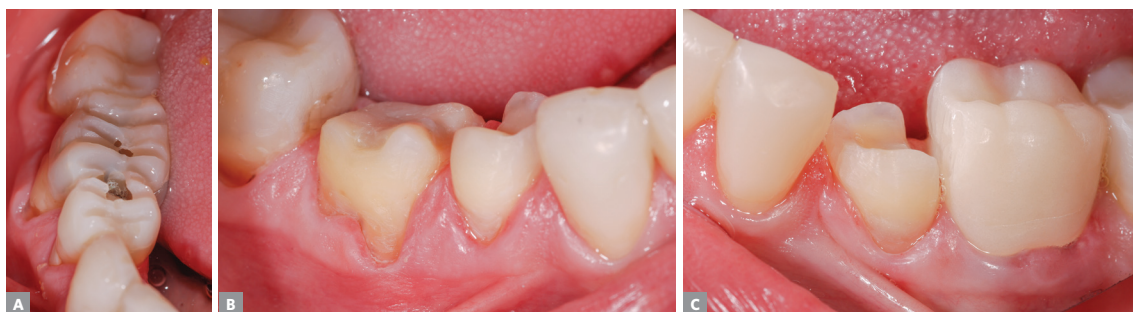


Figure 13: Beginning of the sectorized removal of the composite resin and conservative preparations.



Figure 14: Finishing of preparations.



Figure 15: Appearance of the first sector preparations after immediate dentin and resin sealing coating.

105



Figure 16: Acrylic structures made in CAD-CAM, for inter-occlusal registration.

Indirect restorations in lithium disilicate (Emax, Ivoclar Vivadent, Schaan, Liechtenstein) for elements # 45, # 46, # 35 and # 36 were prepared and cemented in an adhesive form (Fig 17). With stable occlusion, it was possible to choose the sequence of preparation and molding of the upper arch (Fig 18). Preparations for full veneers were performed from canine to canine and also on the premolar # 24, with the aid of preparation guides made of silicone on the diagnostic wax-up (Fig 19A and 19B). Teeth # 16 and # 26 were prepared for partial overlay restorations, with proximal involvement and buccal coverage (Fig 19C).

The gingiva of the upper preparation was shifted by the double cord technique (Fig 20).



Figure 18: Beginning of the preparations of the second sector.

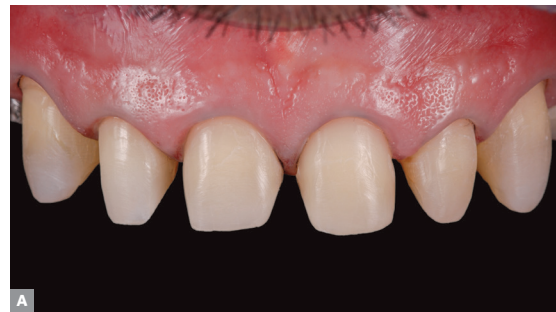


Figure 19: Finished upper preparations.

106



Figure 17: Restorations in lithium disilicate in model (A) and after cementation (B).



Figure 20: Upper preparations after gingival shift.

The serial removal of the provisional restorations allows the space for the restorative material to be checked (Fig 21A) and the interocclusal recordings were made on a temporary light-curing resinous material (Revotek LC, GC America Inc., Alsip , Illinois, USA) (Fig 21).



Figure 21: Available inter-occlusal space (A) and registration with resinous material (B).

The upper indirect restorations were also manufactured in lithium disilicate (Fig 22), a material that allows reduced thicknesses in full crowns of the full veneer type, both in anterior (Fig 23) and posterior (Fig. 24) teeth. A subtle cervical finish line was drawn in the preparations (Fig. 25). The restorations were tested, adjusted and cemented adhesively with resin cement (Base Paste, Variolink N, Ivoclar Vivadent, Schaan, Liechtenstein) (Fig 26). The aspect after cementation of the upper arch shows the difference between the ceramic restorations and the composite resin (anteroinferior teeth) (Fig 27).

The next sector selected for ceramic finishing was the lower anterior sextant. As the composite resin played the role of restorative test, preparations for laminates in this region were done following the mock-up strategy, where depth orientation grooves were made on the resin surface (Fig 28). With finished and molded preparations (Fig 29), the lithium disilicate ceramic laminates were made, tested and cemented (Fig 30). There was a favorable integration between the upper and lower ceramics (Fig 31).

Subsequently, elements # 17 and # 27 were rehabilitated, also with partial restorations of reduced thickness (Fig 32). The last sector to be rehabilitated was the lower distal elements, # 37 and # 47 (Fig 33). With the restorations made and cemented (Fig 34), the sectorized installation of the rehabilitation was completed (Fig 35). A protective acrylic occlusal plate was installed (Fig 36), and the patient was instructed to attend weekly appointments for occlusal adjustments until total comfort with the restorations.

In the images made 6 months after the end of the treatment, it was possible to observe the



Figure 22: Ceramic parts in the model.

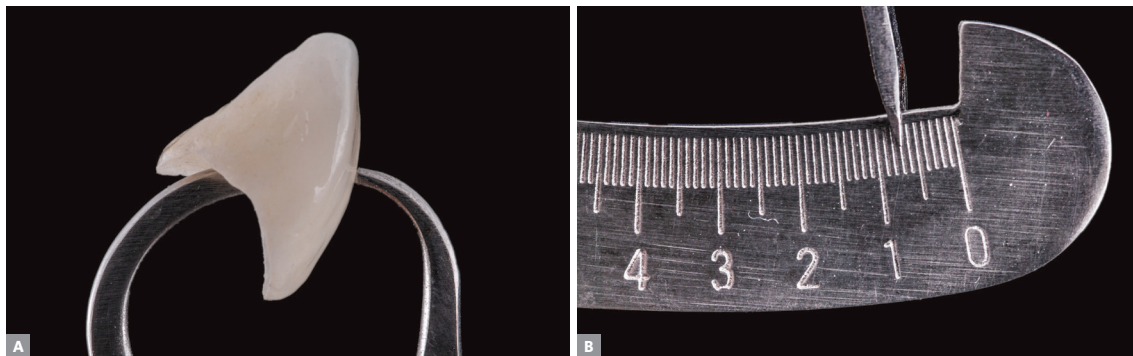


Figure 23: Full anterosuperior veneer (A) with a thickness of 0.7 mm (B).

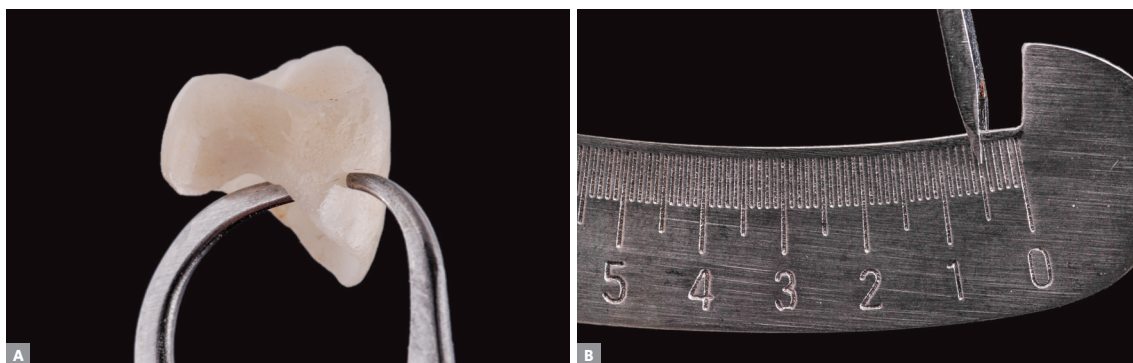


Figure 24: Full upper premolar veneer (A) with a thickness of 0.5 mm (B).

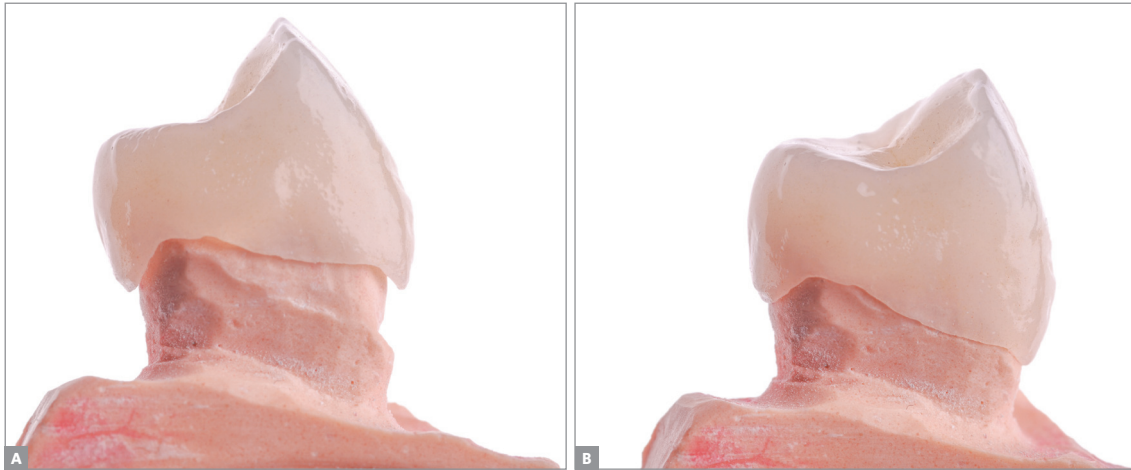


Figure 25: Adapting the piece to the die.

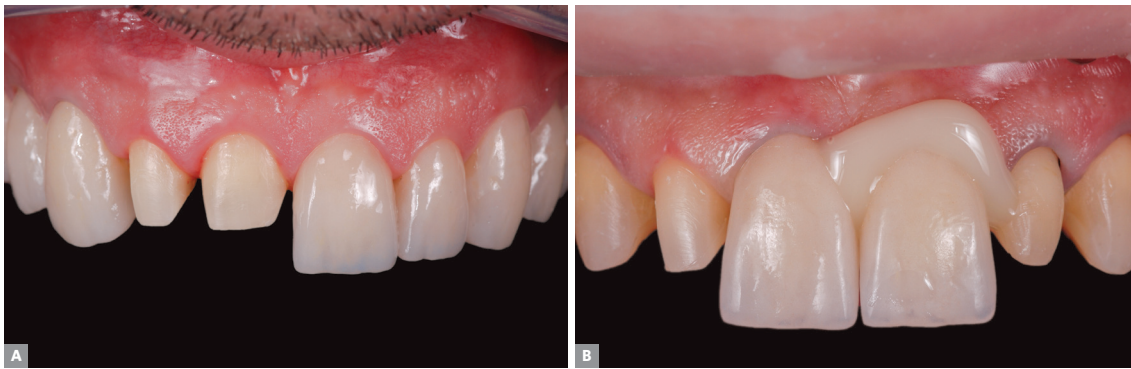


Figure 26: Upper restoration test (A) and cementation (B).



Figure 27: Anteriosuperior sector finalized.



Figure 28: Preparation sequence on the anteroinferior composite resins for ceramic laminates.



Figure 29: Finished preparations (A) and after gingival clearance (B and C).



Figure 30: Parts of the third sector on the model (A) and being tested (B).



Figure 31: Appearance after anteroinferior cementation.

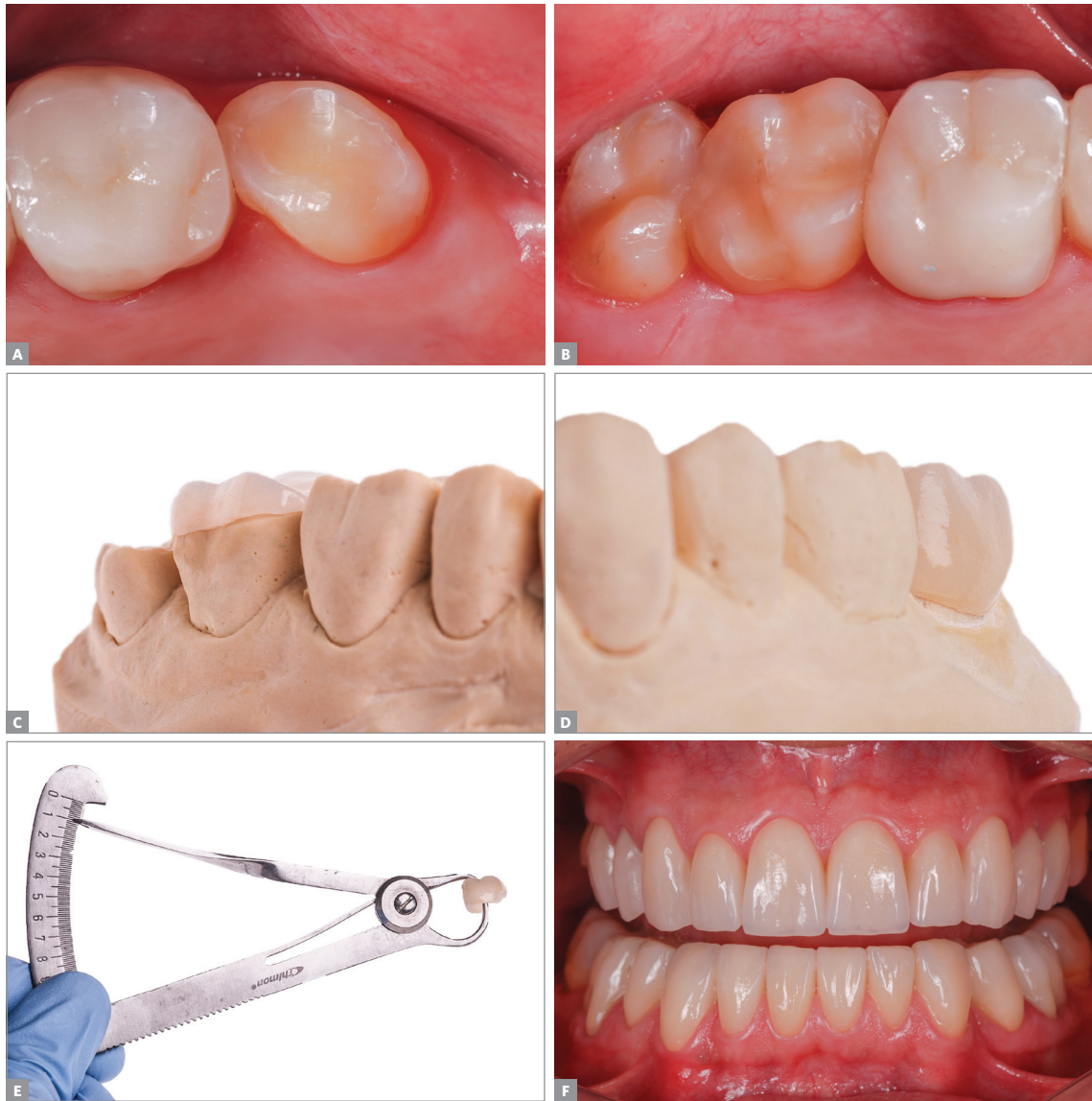


Figure 32: Rehabilitation of the fourth sector (# 17 and # 27).



Figure 33: Preparation of elements # 37 and # 47 (fifth sector).



Figure 34: Completion of the fifth and last sector.



Figure 35: Final appearance of cemented restorations.



Figure 36: Protection plate.

achieved occlusal harmony in both CR and excursive movements and the appropriate design of the new occlusal plane (Fig 37). The extraoral im-

ages evidenced the correct dental exposure with the lip at rest, besides the improved aesthetic appearance after the treatment (Fig 38).



Figure 37: Final intraoral appearance after 6 months in occlusion (A) and excursive movements (B, C, D).



Figure 38: Extraoral appearance after 6 months.

DISCUSSION

Treating worn-out dentitions is not a new concern. In 1984, classifications and treatment options for these patients were already found in the literature.¹⁶ Currently, a patient can be diagnosed with a severely worn dentition when presenting dental wear with substantial loss of tooth structure, with dentine exposure and significant loss ($\geq 1/3$) of the clinical crown.¹⁷ Several studies have proposed alternatives, classifications and treatment protocols for the rehabilitation of individuals with severe wear, always using adhesive procedures, occlusal planning and the least possible dental wear.^{2,4-8,18-28}

The high success rate of less invasive ceramic restorations, such as laminates and posterior partial restorations, allowed the rehabilitator to perform total rehabilitations with much less wear of healthy dental structure.^{10,20} This is also due to the development of ceramic materials of high aesthetic and functional performance, even in low thicknesses.²¹

The management of VDO becomes an essential ally of minimal invasiveness in the treatment of worn dentitions.¹³ In the case reported in the present study, the increase in VDO allowed a lesser need for preparation and removal of healthy structure in the posterior occlusal, anterosuperior palatal and anteroinferior buccal-incisal surfaces.

The decrease in VDO occurs when the speed of dental wear exceeds the speed of compensatory dental extrusion. It is a more common event in patients who present loss or impairment of posterior occlusal support, overloading the anterior dentition and causing rapid wear or even dental fractures.¹⁶ In patients with marked reduction of VDO, it can be restored without major concerns. In patients who do not show obvious signs of VDO decrease, con-

nience increase is an option for less invasive restorative procedures.¹³ When indicated, the increase of up to 5 mm in the VDO behaves safely and predictably, without deleterious consequences for the stomatognathic system,²⁹ which adapts quickly to moderate vertical changes.³⁰ As a form of diagnosis and orientation to a new maxillary relation, phonetic tests can be used, especially the “S” phoneme.³¹

As the disocclusion to increase VDO necessitates a change in maximal habitual intercuspation (MHI), there is an opportunity to plan and perform rehabilitation in a new maxillo-mandibular relationship. Thus, the CR should be the first choice of position to be registered for mounting in the SAA and confectioning the diagnostic wax-up.^{13,22,32} At the wax-up, concepts of an occlusion as ideal as possible should be applied.³³⁻³⁸

After the correct diagnosis and determination of the treatment plan, the implementation of those rehabilitations goes through an important step: the temporary increase of the VDO and its follow-up. Be with removable devices or by means of adhesive-fixed provisional, the time for the stomatognathic system to adapt to the new maxillomandibular relationship and VDO must be respected, and adjustments should be made as necessary. This time is variable, but it is reported that muscle activity returns to pre-treatment level 2 to 3 months after occlusal modification.²⁹ The provisional increase of the VDO with composite resin based on diagnostic wax-up has been shown to be an effective technique in obtaining a correct occlusal design, which can be adjusted and without the inconvenience of using a removable device.^{2,5} This stage facilitates the sectorized prosthetic sequence.¹⁵

Preparations are performed in the least invasive manner possible, aiming to obtain space

for the restorative material and insertion axis of the pieces.³⁹ At this time, the procedures for immediate dentin sealing are indispensable for long-term adhesion.^{40,41}

The protocol of clinical and laboratory execution and the behavior of lithium disilicate-based ceramic restorations are well documented and must be respected for longevity. The crucial step in this process seems to be the moment of adhesive cementation.^{9,11,12,22}

According to the European Consensus on Severe Tooth Wear,¹⁷ the treatment of individuals with worn dentition should follow some guidelines: 1) restorative treatments should be as conservative as possible, involving the least number of teeth required to obtain satisfactory clinical results ; 2) whenever possible, the preparations should be restricted to the creation of the necessary characteristics, such as insertion and finish lines, to facilitate the positioning of the restorations; and 3) the

selection of materials and techniques should take into account the expectations, aesthetic demands and the risk profile of each patient, besides the operator's skills and knowledge, patient availability for follow-up visits and any financial restrictions.

CONCLUSION

Total rehabilitation of severely worn dentition must be indicated and planned cautiously and judiciously, to avoid the risk of under or over treatments, and executed with precision so that the longest longevity is secured. Occlusal planning and adherence of etchable materials may lead to a smaller need for dental wear and to satisfactory aesthetic and functional results.

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