CASE REPORT

OCCLUSAL VENEERS AND DSD NATURAL RESTORATION FOR THE REHABILITATION OF BIOCORROSION

LAMINADOS OCLUSAIS CAD-CAM E DSD-NATURAL RESTORATION PARA A REABILITAÇÃO DA BIOCORROSÃO

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Resumo

Os hábitos de vida modernos culminaram com o aumento na incidência da biocorrosão e na demanda por abordagens reabilitadoras estéticas minimamente invasivas. Do mesmo modo, o aprimoramento da Odontologia adesiva, materiais restauradores e sistemas *Computer Aided Design and Computer Aided Manufacturing* (CAD/CAM) permitiram resoluções estéticas com abordagens digitais eficazes e tempo clínico minimizado. Este trabalho tem como objetivo relatar uma reabilitação oral empregando laminados oclusais cerâmicos ultra finos posteriores para o restabelecimento da dimensão vertical, associados à abordagem sanduíche ântero-superior (laminados palatinos em compósito semi-diretos e laminados cerâmicos vestibulares) para a restauração da biocorrosão. A reabilitação foi realizada em CAD-CAM, utilizando a anatomia do banco de dados do software (biogenérico individual) para os elementos posteriores. Por outro lado, a anatomia anterior foi obtida pela cópia de dentes naturais através da integração entre o *Digital Smile Design* (DSD) e o sistema CAD-CAM (DSD-*Natural Restoration*). Portanto, o uso do sistema CAD-CAM no modo *chairside* conferiu agilidade ao procedimento reabilitador. Além disso, o DSD-*Natural Restoration* aprimorou a macro e microestética dos laminados cerâmicos.

Palavras-chave: Erosão dentária. Desenho assistido por computador. Facetas dentárias.

Abstract

Modern life increased the incidence of biocorrosion, demanding aesthetic and minimally invasive approach for the rehabilitation of these patients. At the same time, the improvementof adhesive dentistry, restorative materials and Computer Aided Design and Computer Aided Manufacturing (CAD/CAM) systems allowed the improvement on aesthetic with minimized time using effective digital approaches. This manuscript presents an approach with ultra-thin occlusal veneers to augmentation of vertical dimension and sandwich approach (semi-direct composite on palatal and ceramic on labial) to restore biocorrosion. The full mouth CAD-CAM rehabilitation involved posterior occlusal veneers using the software´s anatomic database (biogeneric individual) and natural anterior algorithms obtained by integration between Digital Smile Design (DSD) and CAD-CAM (DSD - Natural Restoration). Therefore, the chairside mode is effective and less time consuming, associated to DSD-Natural Restoration improved anterior esthetic for labial ceramic veneers.

Keywords: *Tooth erosion. Computer-Aided Design. Dental Veneers.*

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INTRODUCTION

Restoring smiles achieving a natural result is a challenge in restorative dentistry, and a concern associated with digital workflows. However, macro and micro aesthetics are related to planning, using facial, oral and dentogingival analysis (1); including the six lines of the smile (cervical line, papillary line, line of contact points, incisal line, line of the upper lip and line of the lower lip), essential in the process of planning and design of restorations (2). With technological advances, the use of digital tools for planning confers more predictable and aesthetic results. The Digital Smile Design (DSD) is the most widespread among the digital tools.

DSD consists of the analysis of extra and intraoral photographs, with the help of digitally traced lines and drawings based on facial references. Thus, DSD allows case planning by integrating functional and aesthetic needs, always in harmony with the patient's face, besides facilitating communication with the patient and multidisciplinary team (3). Currently, this tool can be associated with the patients' digital models, allowing the planning in 3D, which includes digital waxing, thus providing a greater predictability to the result (4).

The digitization of the models and their integration to the patient's photographs (facial references) associated with the digital libraries containing morphologies of natural teeth, allowed the development of the DSD Natural Restoration (DSD NR) (4). This flow provided the execution of 3D planning, conferring greater biomimetism when using the natural tooth morphologies, enabling the milling of restorations with improved aesthetics (5). The DSD NR is a flow for milled monolithic restorations, dismissing the need for the ceramist's aesthetic work.

The Computer-Aided Design and Computer-Aided Manufacturing (CAD-CAM) system shed new light on extensive rehabilitation, since they allow us to scan, design, mill and cement restorations on the same appointment of tooth preparations, without the need for temporary restorations (6). Moreover, the digital workflow streamlines the restorative steps for the professional, also providing visual communication with the patient (7). CAD-CAM also facilitates the uniformity of the thickness and anatomy of restorations during the manufacturing process (8), especially in laminates, which are extremely thin restorations and require extreme technical skill (9). Besides, the milled restorations presented better adaptation when compared with those obtained by the conventional method (10), although this factor may also be related to the operator.

Biocorrosion is characterized when the patient presents wear marks due to acid dissolution (intrinsic or extrinsic) without bacterial involvement (11). The modern lifestyle generated eating and behavioral habits that contributed to increase its prevalence (12). The rehabilitation of these patients is marked by the challenge of restoring the lost structures, avoiding further wearing the substrate. Given this context, the use of occlusal laminates involving minimal wear on the posterior teeth seems promising (11,12). Based on the same perspective, the anterior bilaminar approach (semi-direct composite laminates on the palate associated with vestibular ceramic laminates) allows the preservation of vitality and marginal crests of these elements. Associated with DSD-NR, it was possible to confer natural anatomical, macro and micro texture characteristics to milled monolithic restorations performed directly in the clinic (chairside).

Therefore, this case report aims to present a minimally invasive approach to the rehabilitation of biocorrosion wear, involving posterior occlusal laminates associated with the anterior bilaminar approach. Digital planning guided all stages of the treatment that was performed in chairside mode.

CASE REPORT

A 39-year-old male patient presented to the clinic of Phosthodontics Postgraduate Degree Program at the Department of Prosthesis and Dental Materials of the Faculdade de Odontologia da Universidade Federal do Rio de Janeiro (FO-UFRJ), requesting treatment for tooth sensitivity and dental wear. In the first appointment, the clinical examination showed generalized enamel loss with signs compatible with biocorrosion (Figure 1A-C). The patient reported to be investigating gastroesophageal reflux disease (GERD) and events compatible with sleep bruxism. The pattern of concentrated dental wear on the palatine faces of the maxillary teeth and the patient's medical history reinforced the hypothesis of intrinsic origin associated with GERD (13). The planning was presented to the patient, who agreed and signed and informed consent form.

Figure 1 - (A) Initial aspect of the smile. (B) and (C) Maxillary and mandibular occlusal sight evidencing occlusal wear.

The treatment was organized in three sectors:

1. Occlusal laminates in lithium disilicate in molars, L-veneers in the second premolars, performing one quadrant per appointment;
2. Semidirect resins on the palatine of maxillary anterior teeth and
3. Vestibular laminates in the maxillary anterior teeth obtained by the integration between the DSD and a software for the design of restorations (DSD Natural Restoration).

Posterior Rehabilitation With Ultrathin Occlusal Laminates And L-Veneer

In the planning stage, immediate dentin sealing (IDS) was performed for sealing the exposed dentin (14) before home bleaching with 10% carbamide peroxide (Opalescence, Ultradent Products Inc, USA). The teeth presented alteration of the initial coloration from A4 to A3 based on VITA Classical shade guide (Vita, Bad Säckingen, Germany).

During planning, the position of Centric Relation (15) was recorded with the aid of the Lucia JIG, thus allowing the assembly in a semi-adjustable dental articulator, increasing the Vertical Dimension of Occlusion (VDO) by 1.5 mm. Then, the diagnostic waxing was performed based on the anatomy and incisal curvature established in the DSD (PowerPoint; Microsoft office 16). Subsequently, the additive waxing was conducted in two stages: 1- Waxing of maxillary anterior teeth based on DSD; 2- Waxing of maxillary posterior teeth after restorative testing and establishment of adequate incisal curvature.

In the second appointment, aesthetics, function and new VDO were tested by manufacturing temporary restorations. The new temporary restorations, facial appearance and muscular comfort were tested for 15 days (16). After adaptation to the new VDO and approval of the patient and team, the subsequent temporary restorations were used as reduction guides for the regularization of the occlusal surface and preparations with conical diamond points. The preparations were made through the temporary restoration in the regions that the bisacrilic resin indicated the need for dental reduction (Figure 2 A-D). The mean occlusal dental reduction was from 0.4 to 0.6 mm (central groove) and 1.0 and 1.3 mm (tips of the cusps), generating a minimum space for ultrathin occlusal laminates (9).

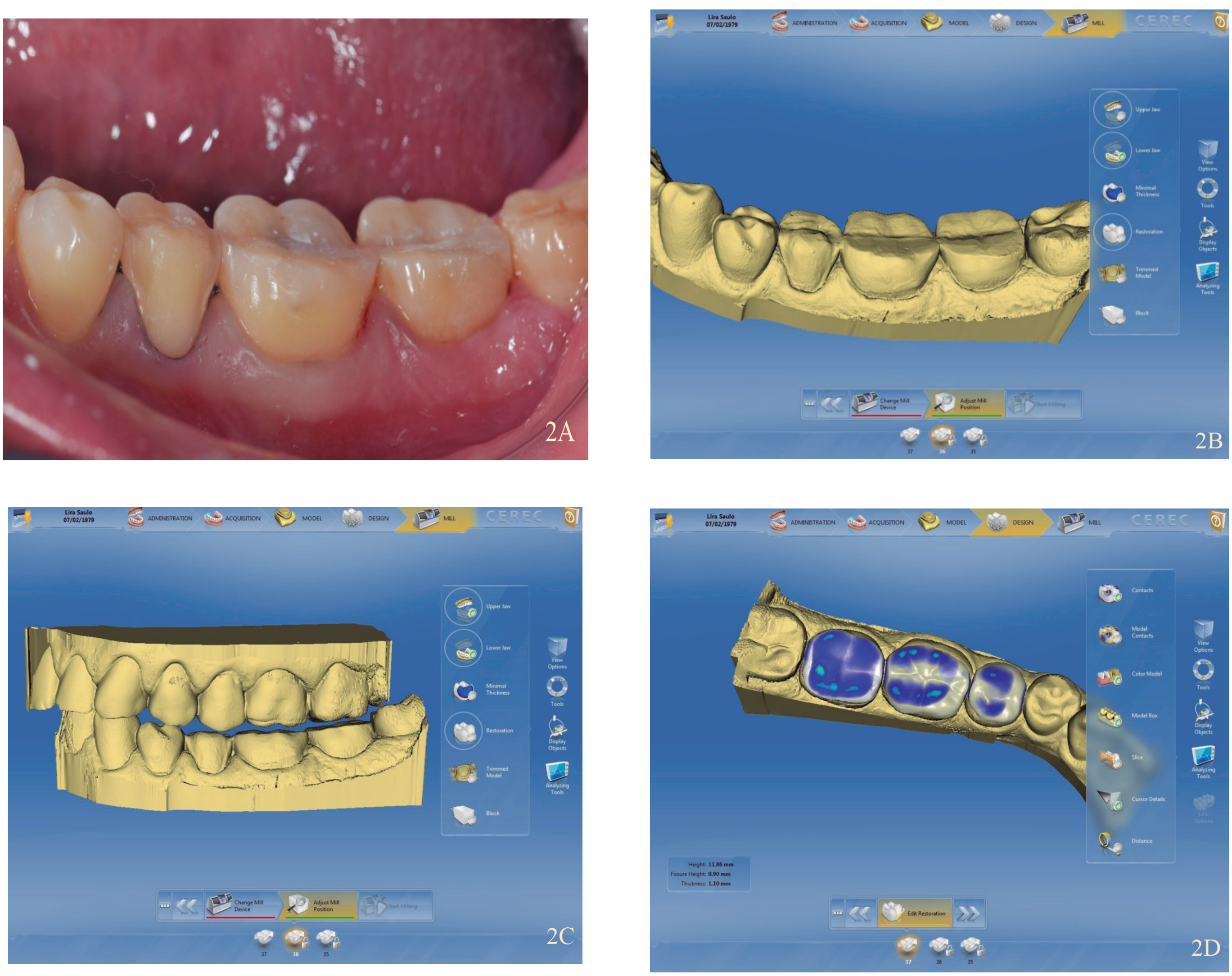


Figure 2 - (A) Final aspect of the preparations in the lower left quadrant; (B) Scanning of preparations. (C) Scanning of the interocclusal relationship maintained by the provisional upper and lower right quadrants. (D) Design of restorations.

For rehabilitation, the four quadrants were divided into sectors (in chairside mode) and in four appointments, which included: preparations, scanning (Cerec AC Bluecam, Sirona Dental Systems, Germany), design, milling (MCXL, Cerec Sirona Dental Systems, Germany), crystallization and glazing of occlusal laminates in lithium disilicate (Emax Cad HT A2, Ivoclar Vivadent, Amherst, NY). Thus, the quadrants opposite to the prepared side maintained the VDO and maxillo-mandibular relationship established with the aid of the JIG and interocclusal recording that originated the relationship between the models, in which the diagnostic waxing was made. Likewise, the temporary restorations in the antagonist quadrant to the preparation were maintained aiming at the establishment of occlusion and height according to the planning in the waxing.

Finally, the occlusal laminates were cemented by conditioning the internal surface with 9% hydrofluoric acid for 20 seconds (Ultradent Porcelain Etch, Ultradent Dental Products, South Jordan, UT, USA) and washing for 40 seconds with oil-free water jet and then silanated (Silane, Ultradent Inc, USA). The preparation of the teeth consisted of 37.5% phosphoric acid conditioning (Ultra-Etch, Ultradent Inc, USA) for 15 seconds, washing for 30 seconds and hybridization with conventional adhesive system containing load (Optibond FL, KERR Corp, USA) according to the manufacturer's instructions. Then, the pieces were cemented with composite (Filtek Z100, 3M ESPE, USA) preheated at 68°C (Calset, Addent, Inc., USA). The laminates were seated, the resin excesses removed, and the parts were photoactivated (Valo, Ultradent Products Inc, USA) for 20 seconds/3× per face at 1000mW /cm2 (Figure 3 A-D).

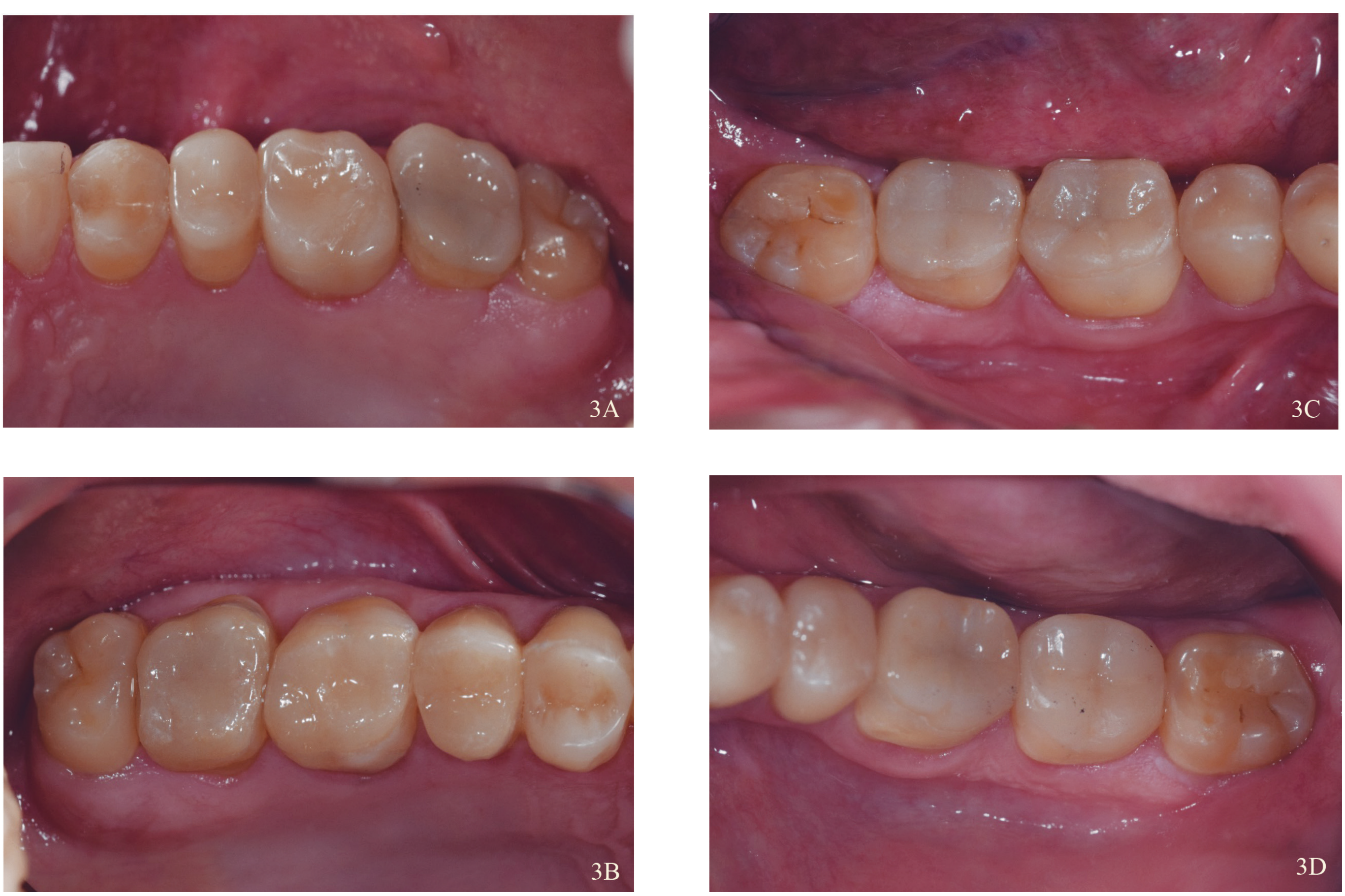


Figure 3 - (A) to (D) Final aspect of the posterior elements after cementing the laminates.

Anterior Rehabilitation: Bilaminar Approach

The palatine anatomy of the six teeth was restored using semi-direct composite (A2, Z350, 3M ESPE, USA) on the plaster model obtained after cementation of all posterior occlusal laminates and restoration of VDO. In the preparation of the surface of the teeth, the same protocol of the posterior restorations was used, followed by cementation using composite preheated at 68°C (Figure 4 A-C).

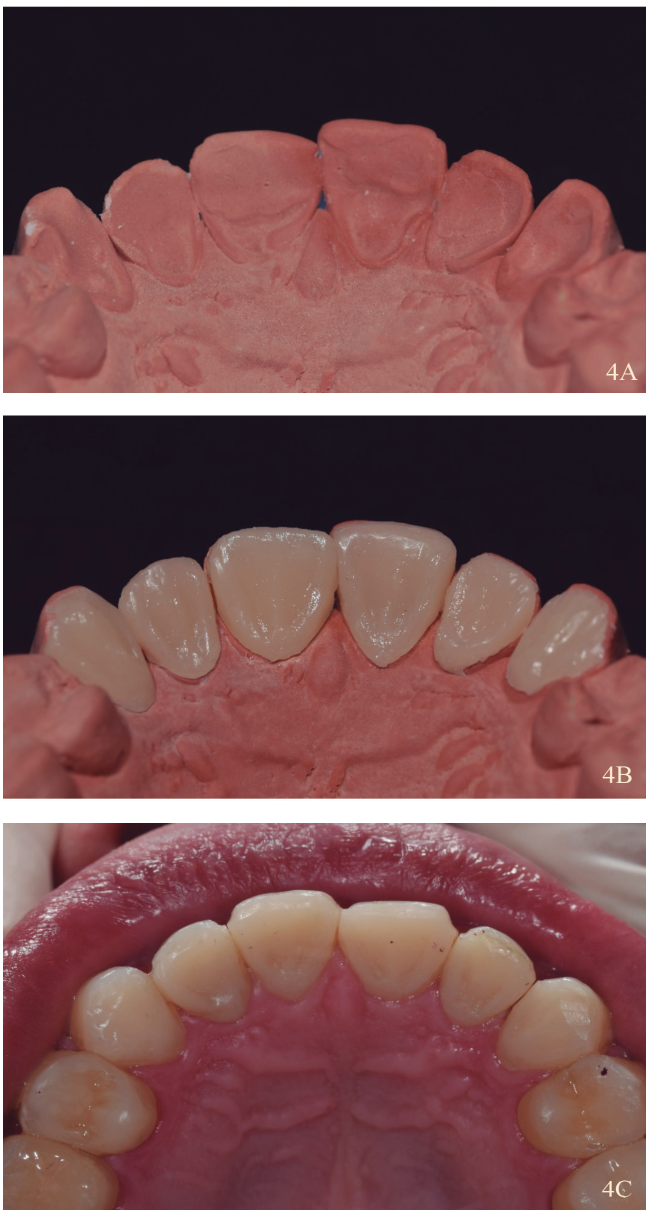
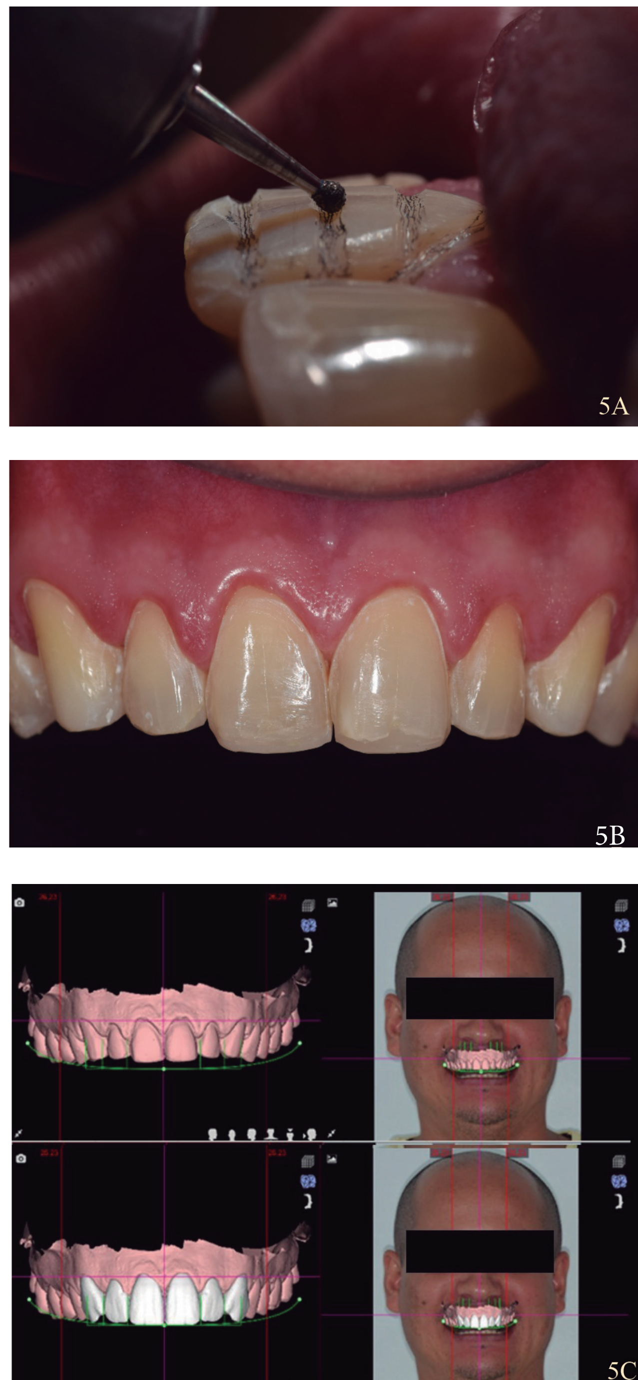


Figure 4 - (A) Plaster model obtained for the manufacture of palatine laminates in composite; (B) and (C) Laminated in semi-direct composite seated in the model and after cementation.

Ceramic laminates were used to restore the vestibular surface. The preparation of the vestibular faces was performed through the mock-up in bisacrilic resin obtained with the aid of digital waxing guided by DSD. The finish conferred the minimum milling thickness (0.3mm) being supra-gingival located, allowing better hygiene, maintaining the emergency profile and interface with the periodontium in dental enamel. The preparations were scanned generating the file of the model on which the initial digital waxing, using morphologies of natural teeth, was adapted (Waxing Over the Prep) (Figure 5 A-D).



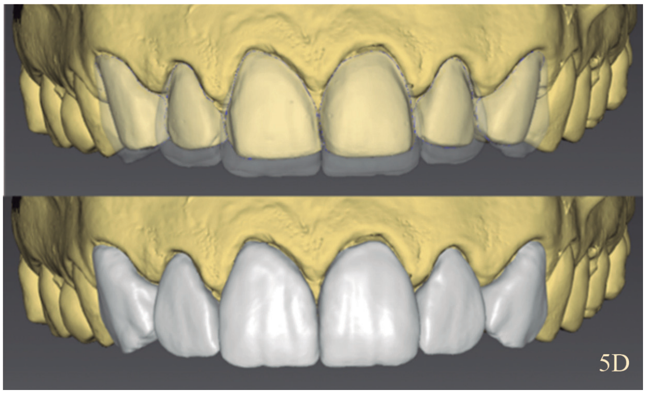


Figure 5 - **(A) minimally invasive preparation guided by the restorative assay containing the anatomy of the definitive restorations; (B) Final aspect of the preparations; (C) Scanning of preparations, integration of the model to the face via DSD and integration of the anatomy of digital waxing based on natural algorithms integrated to the face; (D) Design of restorations on preparations.**

After this step, the STL file containing the three-dimensional information of the digital waxing was exported to the inLab 18 software (Sirona Dental Systems, Germany). The final anatomy of the previous ultrathin laminates was designed by copying the natural teeth used for the DSD (DSD Natural Restoration – DSD-NR). The laminates were milled in leucite-reinforced ceramic (A2, Empress CAD Multi, Ivoclar Vivadent) and finished with the sequence of ceramic polishes (W16Dg, W16Dmf and W16D, EVE Diapol, Germany)

The milled restorations were tested using the try-in neutral paste (Variolink Esthetic paste try-In, Ivoclar Vivadent, Liechtenstein) for the choice of color used in the definitive cement. Since the patient presented a dark substrate (A3), the cement chosen for the definitive fixation of the parts was neutral. The preparation of the parts for cementation consisted of conditioning with 9% hydrofluoric acid (Ultradent Porcelain Etch, Ultradent, USA) for 60s followed by washing for 120s and drying with water-free air jet and silanization.

The preparation of the tooth surface consisted of selective conditioning of the enamel using phosphoric acid 37.5% (Ultradent Products, Inc, USA) for 15s, washing for 30s, drying and application of self-etching adhesive (Clearfil SE bond, Kuraray) maintained without polymerizing. Then the pieces were cemented using light-curing resin cement (Variolink Esthetic LC, Ivoclar Vivadent). Photoactivation was performed for 20s/ 3× per tooth, on the vestibular and lingual faces (VALO, Ultradent Corp, USA). At the end of rehabilitation, a myorelaxant plate was made for the patient (Figure 6 A-C).

Figure 6 - **(A) Final aspect of the smile; (B) Observe the macro and microtexture, copies of natural algorithms reproduced by milling; (C) Acrylic myorelaxant plate.**

DISCUSSION

The main advantage of the approach used is the treatment of biocorrosion employing minimal reduction of the dental structure. In this context, ultrathin occlusal laminates are conservative alternatives to rehabilitate the occlusal surface, preserving the dental structure and using adhesive techniques associated with resistant restorative materials (9, 12).

Likewise, the waxing based on the DSD conferred predictability to the treatment (3,17), being essential in the establishment of the incisal plane and guiding the Spee Curve (18). Moreover, the preparation of restorations using the CAD/CAM system accelerated the workflow allowing the completion of one segment for each session.

Among restorative materials tested for ultrathin occlusal laminates, milled composites and ceramics met the biomechanical requirements (9,11,12). However, the composites present greater wear and changes in color. Therefore, it was chosen the milled lithium disilicate glass-ceramic, considering its superior performance in color, marginal integrity and less wear than composites (11).

Regarding the cementation of occlusal laminates, the preheated composite presented the following advantages: longer working time, ideal consistency for laying and removal of facilitated excesses, in addition to better mechanical properties due to higher load content and higher degree of conversion, increasing the amount of polymers, which makes it a "gold standard" for the cementation of posterior ceramic partial restorations (19-21). In addition, previous studies that support the use of ultrathin occlusal laminates have used preheated composites as a protocol (9).

In this case report, the preparation of the anterior laminates was through the DSD-NR (22), involving the integration between the DSD and the STL file resulting from the patient's scanning, enabling the preparation of a 3D waxing (NemoSmile Design 3D, Nemotec, Spain) and the use of a database with morphologies of natural teeth (4).

We emphasize that the rehabilitation treatment presented is limited to the treatment of the wear by biocorrosion, neither removing the etiological factors of biocorrosion, nor constituting the treatment of parafunction. Therefore, in this case, the use of occlusal plaque is indispensable, and the patient should be followed-up to have the etiological factors causing biocorrosion and parafunction controlled, thus avoiding further wear. Likewise, we recommend further studies on the longevity of these rehabilitations using occlusal laminates.

CONCLUSION

This clinical report supports the use of minimally invasive approaches for function and aesthetics efficient rehabilitation, using the CAD-CAM system in chairside mode. The evolution of adhesive systems, restorative materials and CAD-CAM systems were essential to enable the use of laminates in minimum thickness, avoiding excessive wear in patients with biocorrosion. Likewise, our approach emphasized the importance of planning for minimally invasive rehabilitation based on additive waxing. Thus, digital waxing using natural tooth anatomies based on DSD conferred refined aesthetic results using milled restorations. This approach significantly improved the use of these technologies as allied in the planning and execution of anterior and posterior minimally invasive rehabilitations.

Conflict of Interest

The author Ângelo Raphael Toste Coelho Segundo is one of the developers of the DSD Natural Restoration Technique. The authors declare no conflict of interest.

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