DIGITAL SMILE DESIGN AND ITS CONTRIBUTION OF CERAMIC LAMINATES

DESENHO DIGITAL DO SORRISO E SUA CONTRIBUIÇÃO PARA CONFECÇÃO DE LAMINADOS CERÂMICOS

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RESUMO

Em tempos modernos, a beleza e o cuidado estético apresentam grande relevância na sociedade. Com isso, foram desenvolvidas tecnologias, dentre elas o Digital Smile Design (DSD), utilizado na odontologia como ferramenta auxiliar na confecção de trabalhos reabilitadores, a fim de integrar o planejamento estético com as necessidades funcionais do paciente. Com essa ferramenta, é possível a simulação antecipada do resultado, com a participação ativa do paciente. Nesse estudo objetivase relatar um procedimento de reabilitação estética por meio da confecção de laminados cerâmicos de espessura reduzida com o auxílio do planejamento digital pelo sistema DSD. O tratamento resultou em uma reabilitação por meio de laminados, com a utilização de planejamento digital DSD, proporcionando, ao seu final, maior conforto, funcionalidade e melhor adequação visual e estética à paciente. Em conclusão, o DSD é uma ferramenta que possibilita ao cirurgião-dentista a entrega de trabalhos com precisão, o que reduz as chances de insucesso e retrabalhos, pois possibilita a participação efetiva do paciente e demais profissionais envolvidos, aumentando a segurança e a satisfação do paciente. Proporciona redução do tempo de tratamento, além de representar uma excelente ferramenta de marketing e entrega de resultados de excelência. Por outro lado, a aplicação da referida tecnologia não substitui o diagnóstico preciso do caso, treinamento e experiência clínica do profissional, além de se considerar o elevado custo financeiro para sua aplicação.

Palavras-chave: Digital. Sorriso. Design. Estética e Reabilitação.

ABSTRACT

In modern times, beauty and aesthetic care have great relevance in society. As a result, technologies have been developed, including Digital Smile Design, used in dentistry as an auxiliary tool in the creation of rehabilitative work to integrate aesthetic planning with the patient's functional needs. With this tool, it is possible to simulate the anticipated outcome, with active patient participation. This study aims to report a procedure for aesthetic rehabilitation through the creation of thin ceramic veneers with the assistance of digital planning using the Digital Smile Design system. The treatment resulted in a rehabilitation with ceramic veneers that provided greater comfort, functionality, and improved visual and aesthetic adaptation for the patient. In conclusion, Digital Smile Design is a tool that allows dentists to deliver precise work, reducing the chances of failure and rework, as it enables the active participation of the patient and other professionals involved, increasing patient safety and satisfaction. It provides a reduction in treatment time and represents an excellent marketing tool for delivering excellent results. On the other hand, the application of this technology does not replace accurate case diagnosis, training, and clinical experience of the professional, and it should be considered that it has a high financial cost for its implementation.

Keywords: Digital. Smile. Design. Aesthetics and Rehabilitation.

INTRODUCTION

In current times, society shows a strong concern for aesthetic care, which has become one of the most attractive elements in the market. In dentistry, this objective also receives great prominence, with the pursuit of a more harmonious smile that meets established general standards. This has led to increased patient expectations and demands on dental professionals. Despite this increase, patients have shown a preference for more conservative procedures with the aim of restoring shape, position, contour, alignment, function, contact, and occlusal guides, in addition to the aesthetics of the treatment[1].

During the planning phase, it is necessary to perform a functional analysis of the case, seeking the possible causes that led to dental alterations, including factors such as loss of vertical dimension of occlusion (VDO) that needs to be restored, including disclusion guides, occlusal discrepancies, malocclusion, and parafunctional habits. From there, the rehabilitation of the anterior segment, which is considered an important aesthetic component in dentistry, can be planned[2].

It is evident that proper planning of interventions in oral rehabilitation enables better results and, as a consequence, greater patient satisfaction. Therefore, prior intraoral and extraoral photographic records become necessary to allow for better case planning. In this regard, the Digital Smile Design (DSD) software is a facilitator of this process1. With the use of this program, it is possible to perform facial analysis, smile analysis, periodontal tissue analysis, and dental analysis by visualizing the digital mock-up3, making the results more predictable and allowing for a careful analysis by both patients and dentists, establishing a closer relationship between expectation and reality1. The importance of dynamic facial registration during smiling, laughing, and speaking through video recording is also emphasized, integrating facial aspects with the smile contour[4].

The effective participation of the patient, who becomes the main collaborator, actively establishing their treatment plan, is one of the main advantages provided by the adoption of this technology. The tool allows for the creation of a customizable protocol, enabling the choice of the most suitable result according to the patient's own satisfaction, as visualized in the program[5].

The planning of oral rehabilitation through software eliminates the need for temporary materials and does not damage dental structures, respecting the guidelines of aesthetic dentistry, such as the golden ratio, symmetry, and width-to-length ratio[6].

With the advent of technology, the field of veneers has changed considerably, allowing for infinite possibilities and workflows, including printed models, incorporation of natural forms, milled restorations, and facial integration7. This minimizes potential errors in anterior tooth rehabilitation[2]. In cases requiring gingival correction, it becomes possible to construct a guide that allows for precise gingival contouring, resulting in successful clinical outcomes[3].

Lithium disilicate-based ceramics exhibit properties similar to natural teeth, such as compression strength, biocompatibility, thermal conductivity, color stability, longevity, refractive index compatible with tooth enamel, and aesthetic appearance similar to dental tissue. It is also noted that this system can involve crowns on implants, partial and full restorations, fixed prostheses, and ceramic veneers, allowing for minimally invasive, thin preparations and, in certain situations, no need for tooth preparation[1].

The objective of this study is to report a clinical case of aesthetic rehabilitation using thin ceramic laminates (Dental Veneers) with the aid of the DSD (Digital Smile Design) program, in order to highlight the step-by-step treatment process.

CASE REPORT

A 36-year-old female patient sought dental care with the main complaint of aesthetic dissatisfaction regarding her smile due to the discoloration of composite resin veneers on her upper teeth. During the clinical examination, it was observed that teeth 11, 12, 14, 15, 16, 21, 22, 23, 24, and 25 appeared stained and were in disharmony with the other dental elements, in addition to gingival unevenness, overbite, and midline deviation.

PLANNING

To provide appropriate treatment for the patient, it was necessary to perform the aesthetic and functional planning of the case, facilitated by the use of the DSD program combined with a photographic protocol, aiming to analyze orofacial proportions.

The aesthetic analysis of the face associated with the smile was obtained through extraoral and intraoral photographs taken with a professional camera equipped with a macro lens and a flash, following the photographic protocol. Imaging exams were also requested, such as panoramic radiography, aimed at evaluating previous procedures such as implants, crowns, and endodontic treatments, and computed tomography to assess the size of the alveolar ridge for gingival contouring (gingivoplasty) or crown lengthening. Intraoral scanning was also performed to visualize the current situation and upload the data to the software, and a cephalometric radiograph was taken to evaluate the projection of the chin and maxilla.

Based on the images obtained in the photographic protocol, they were sent to the DSD Planning Center located in Madrid, Spain, where the analysis and planning of the case were carried out using the software. The photograph used to initiate the planning was the forced smile (Figure 1), where the program draws lines

that position the model to the patient's face, respecting the guidelines of aesthetic dentistry. It was possible to identify an imbalance between the right and left upper hemi-arch, gingival unevenness, and midline deviation, confirming the initial clinical examination.

Figure 1 - Intraoral and facial photos of the patient with a forced smile.

For the next step, the program provided pre-treatment models (Figure 2) inserted in an ideal position, which were important for treatment planning and as a preparation guide. In some cases, the treatment can proceed directly to restorative treatment. In a subsequent step, an ideal design was presented on the original model, which represented the post-treatment models (Figure 2) with dental reductions and correction of gingival zeniths. This depicted the ideal tooth size for the patient, which was determined to be 73% (Figure 2). This information allowed for the 3D printing of models using prototyping techniques, which assisted in the treatment by enabling the creation of a silicone guide for the immediate provision of bis-acrylic resin provisional restorations. Additionally, a surgical guide was created for gingivoplasty planning using the model with the cervical measurements of the teeth as a reference. The purpose was to reshape the gums, making them more harmonious and balanced with the patient's smile. The planned modifications were depicted, including measurements of overbite and overjet.

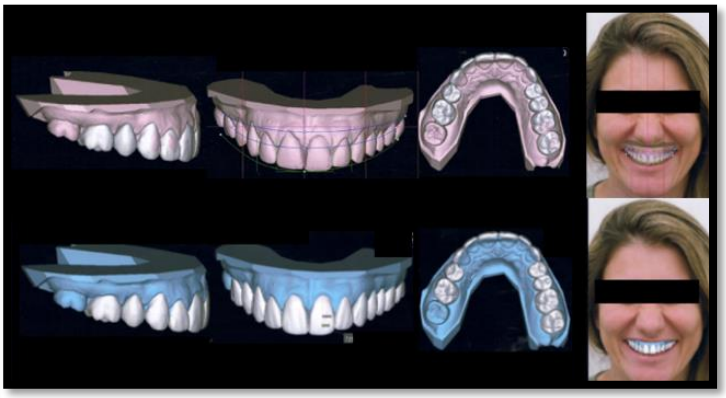

Figure 2 – Ideal pre-treatment models in pink and ideal post-treatment models in blue, showing the ideal proportion of central incisors.

Finally, a motivational mock-up was presented, which is the ideal design adapted to the patient's mouth in relation to the original model. It serves as a test drive of the ideal smile. With the help of the software, it was possible to hide the visible teeth so that the patient could better appreciate the potential result. Consequently, before and after images were created for the patient with the inserted model.

Following the planning provided by the DSD program, careful evaluation, and respecting the patient's desires, it was decided to remove the existing composite resin veneers and proceed with the preparation and fabrication of ceramic laminates.

OPERATIVE SEQUENCE

The treatment began with prophylaxis, followed by the regularization of the incisal edge of tooth 21 using a diamond bur 2135 (KG Sorensen), in order to adjust its size in relation to the central incisor on the opposite side. This was followed by a 30-day at-home bleaching protocol in the lower arch to achieve a

balance in tooth color with the future ceramic laminates.

In a second step, a test-drive of the case was performed using a silicone mock-up (Figure 3), polymerized by addition, to create provisional restorations using B1 shade bis-acrylic resin (Structur 3 - Voco). These provisionals were fabricated over the post-treatment mock-up provided by the DSD, which served as a diagnostic wax-up. At this point, the patient was able to visualize the potential outcome of the treatment (Figure 3) and could approve the treatment plan or suggest any changes.

Figure 3 - Final aspect after the preparation for the fabrication of ceramic veneers with the use of a silicone guide for selective wear. Final aspect after the placement of the mock-up made of bis-acrylic resin with the aid of a silicone mock-up.

With the patient's approval, the unsatisfactory 12 composite resin veneers were removed using a multi-layered tapered bur 18 (Prima Dental by Angelus). Subsequently, the tooth preparations for the veneers were performed using diamond burs 1013, 4138, and 4141 (KG Sorensen), based on the final shape of the restoration, as determined by the diagnostic wax-up and a silicone guide (Figure 3) polymerized by addition. This guide assisted in promoting minimally invasive enamel reduction limited to 0.2 to 0.5 mm thickness, with enamel margins on the vestibular, palatal, and occlusal surfaces. The preparations were then finished using sanding discs (ExpressTM XT, 3M ESPE Dental Products). At the end of this step, the appearance of the tooth substrate was observed (Figure 3).

Subsequently, a new intraoral scan was performed using a single retraction cord (Ultrapak - Ultradent) size 000 to displace the gingiva and create an emergence profile. This allowed for the creation of a new 3D printed mock-up of the patient's actual oral situation. Following this, the shade selection was performed using the Vitapan Classical shade guide (Vita Zahnfabrik), and the BL3 shade was chosen for the fabrication of the ceramic restorations by the dental laboratory. The patient was then dismissed with the temporary mock-up made from bis-acrylic resin.

After receiving the ceramic veneers made of Lithium Disilicate (e- max Ivoclar - Vivadent), the patient returned to the dental office for the finalization of the treatment. Firstly, the provisional restorations made of bis- acrylic resin were removed, and then the ceramic veneers were tried on and adjusted in the mouth. During the try-in, try-in pastes (Allcem Veneer - FGM) were used to determine the most suitable cement shade. With the adjustments made, the veneer treatment protocol began with etching the veneers using 10% hydrofluoric acid (Condac Porcelana - FGM) for 20 seconds, creating micromechanical retention for the resin cement. The veneers were then washed and dried, followed by the application of silane (Maquira) for 1 minute in two coats, with excess solvent being removed by a gentle air stream, promoting better chemical retention. The adhesive system (Tetric N-Bond Universal - Ivoclar Vivadent)

was applied as the final step. For the tooth preparation, cleaning was performed with pumice (Extra Fine - SS White), followed by thorough rinsing and conditioning with 35% phosphoric acid (Ultra Etch - Ultradent) for 15 seconds on enamel, followed by rinsing, drying, and application of the single-bottle adhesive system. For the permanent cementation stage, the light-activated resin cement (Variolink Veneer High 1 - Ivoclar Vivadent) was applied inside the veneers, which were then sequentially positioned and cemented one by one using a clinica tip (CVDentus®) to ensure proper adaptation to the tooth structure. Excess cement was removed with brushes, and then each surface was light-cured for 40 seconds. Finishing was performed using fine and extra-fine diamond burs 2135F and 2135FF (KG Sorensen) with water spray for cooling. Next, polishing was carried out using specific cups for ceramic polishing (OptraFine - Ivoclar Vivadent) and a felt disc (Diamond Flex - FGM) with diamond polishing paste (Diamond Polish 1.0 - Ultradent). Occlusal adjustments were made, carefully checking the existing contact points and lateral and protrusive movements. Finally, a aesthetically satisfactory and functional result was achieved (Figure 4) that met the patient's expectations.

Figure 4 - Set of dentolabial and facial photos of the patient after the completion of the work.

DISCUSSION

The use of new dental materials, restorative techniques, and digital tools offers important perspectives for clinical practice, including reducing clinical time and ensuring patient satisfaction and confidence in the final outcome. Ceramic veneers are indirect restorations that require more clinical sessions and involve more preparation of healthy tooth structure compared to direct restorations. However, they offer better color stability, less polymerization shrinkage, lower residual polymer content, improved physical properties, less marginal leakage, and increased durability. Therefore, ceramic veneers were chosen as the restorative technique for the presented clinical case. Additionally, enamel preservation is an essential clinical parameter to ensure the success of ceramic veneers, as exposure of dentin can reduce the longevity of the restoration. Thus, in this clinical case, minimally invasive veneers were fabricated, involving only the

enamel, using lithium disilicate ceramics due to their excellent aesthetic value and favorable mechanical properties[6].

The DSD is an important tool for use in esthetic rehabilitations in restorative dentistry, as it facilitates diagnosis, improves communication among multidisciplinary teams, and aids in treatment planning and predictability[2]. The DSD program has applicability in various areas of dentistry and can be used in different specialties. It also enhances communication between the parties involved and improves patient motivation due to the predictability of the results that can be achieved with their treatment[8-10].

To ensure correct digital planning, it is crucial to follow a photographic protocol for better visualization and analysis of clinical issues. Even better results can be achieved through videos, which allow for choosing the perfect moment to capture the photo[2,4]. In the present clinical case, the video feature was not used, but nonetheless, the treatment outcome was satisfactory and met the patient's expectations.

All photographic records are uploaded into the software, providing information for planning, such as vertical and horizontal reference lines that help visualize what needs to be added or subtracted from the dental structures and tissues. Subsequently, a digital record of the dental arch is created based on the reference lines[2,4,6,8]. In this clinical case, an approximate smile simulation was generated using the software, and all the information was transferred to a digital diagnostic wax-up to ensure aesthetic and functional harmony.

The digital wax-up is 3D printed, creating a prototype of the smile, which is then transferred to the patient's mouth using a silicone guide to fabricate the mock-up. The mock-up serves the purpose of providing an aesthetic and functional test for the future ceramic veneers. Only after aesthetic and functional approval, the necessary tooth preparation is performed for the fabrication of the ceramic veneers. The complete digitization of the rehabilitation workflow streamlines the activities of the dentist[2].

The DSD is a very current project and is not yet widely discussed in the scientific field. Therefore, the low number of studies in the literature represents a disadvantage[11]. A more in-depth analysis of the DSD technology and its achieved results will be possible as research advances in this area. The advancements in digital technology may lead to increased competition and consequently make everyday use of DSD more feasible, allowing more patients to have access to this technology.

The DSD does not require sophisticated equipment, but training of technicians is essential[6]. The DSD tool has gained prominence in the global market due to its ability to develop treatment planning without the need for expensive equipment[12]. It is evident that there is a need to discuss the resources involved, as they significantly contribute to the costs associated with DSD technology[13].

Indeed, a significant advantage is the expanded diagnostic vision and the improved ability to assess limitations and risk factors such as asymmetries, disharmonies, and violations of aesthetic principles. By identifying the problems and

visualizing the most effective solution, it becomes easier to plan a treatment that respects the physiology and meets the aesthetic demands of the patient[14,15].

The software allows for the elimination of certain laboratory steps and a better cost-benefit ratio, which results from the reduction of total treatment time and provides greater motivation for the patient, as well as trust in the professional. However, it does present some limitations and barriers, such as the population's access to the necessary technology and the training of the professional team. It should be emphasized that the technology being presented does not eliminate conventional techniques and the technical and scientific knowledge of the dental professional, but rather presents itself as a complementary technology aimed at cost reduction and improved efficiency[10]. Knowledge regarding the quality and quantity of remaining dental structure is essential. Therefore, the characteristics of the dental substrate should be carefully evaluated, and its proper protection should be promoted. In this sense, attention must be paid to the amount of wear during preparation and the choice of cement to be used.

It is important to emphasize that the demands and expectations of the patient should be taken into account, especially when aesthetics are involved. Even when respecting the patient's desire not to undergo gingivoplasty and orthodontic procedures suggested by the DSD program as an additional suggestion for aesthetic improvement during planning, the result of aesthetic rehabilitation was still very satisfactory. This fact reinforces that if all the resources provided by the DSD tool for rehabilitation treatment were used, even more satisfactory results could certainly be achieved.

CONCLUSION

In the presented clinical case, the success achieved with the DSD technology was evident, even without utilizing all the offered and suggested resources by the program. The tool provides important support to the dental professional while minimizing working time, but it does not replace their technical and scientific knowledge. It was possible to clearly express the desired result by simulating the treatment before even testing it on the patient, resulting in quality outcomes. By visualizing the proposed treatments, the patient felt more secure in her choices and consequently more satisfied with the final result.

The use of DSD technology in the reported case came with a high cost. Thus, it can be concluded that access to this tool is still limited for a large portion of the population. It is hoped that with technological advancements and research progress, there will be a reduction in the costs associated with the DSD tool, making it more accessible to dentists and patients, aiming for increasingly efficient and satisfactory results.

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