CASE REPORT

Microveneers and digital smile designer: Planning for a patient with bruxism: A 1-year follow-up

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Abstract

The present case report describes the use of digital smile design for a clinical trial execution, involving periodontal and restorative procedures and preservation with microveneers. This approach allows for more enamel preservation and, as a consequence, more predictable bonding, biomechanics, and esthetics. Such results improve harmonic aesthetic appearance based on predictable procedures. At the end of the treatment, a stabilizing plate was installed for the protection of the microveneers and the elements. The patient was very satisfied with the new smile, as the treatment considered personal wishes regarding the shape, size, alignment, and contour, also considering the control of bruxism with the use of a stabilizing plate.

Keywords:
Dental veneers, digital planning, esthetics, operative dentistry, temporomandibular joint dysfunction syndrome

Introduction

The digital smile design or digital smile designer (DSD) is a tool to plan a virtual smile. The planning uses digital photographs and patient diagnostic data, coupled with scientific, biological, esthetic, and occlusal principles, to create an esthetically pleasing smile.[1]

The design of the new smile is virtually built, based on the intra- and extra-oral photographic protocol at various angles, clinical and radiographic examination, and a complete facial evaluation. The patient’s necessities should be considered so that the treatment represents your personal requires, improving the professional patient relationship, the planning and presentation of the case to the patient, giving the results more predictable.[2,10]

The clinical evaluation should observe the arrangement, alignment, contour, shape, size, color, and texture of the dental elements. The radiographic examination and the assessment of the temporomandibular joint (TMJ) are important complementary exams for the diagnosis and planning in oral rehabilitation.[14]

The esthetic checklist involves the facial evaluation. The macroesthetic elements[3-8] (face, smile, periodontium, shape, and alignment of dental arches) and microesthetic elements[9] (shape, alignment, color, and texture of each individual tooth) are considered. The professional should be attentive of extracting sufficient information from the patient, as the psychological profile can influence the expected final result.[2,10]

The use of DSD allows a comparison of the previous photos with the final result, showing the great difference in esthetics, and giving even more satisfaction for the patient to see was proposed to him and how it has been achieved. The case can be saved, and if patient authorization is given, the treatment can be presented as an example in consultations with other clients seeking esthetic restoration.[2,10]

The test drive of the virtual project materializes in the esthetic test. The mock-up reproduces the waxing with bisacrylic resin and simulates the esthetic. The functional result could act as a surgical guide to correct the esthetics rose by periodontal
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Some authors\(^{14,15}\) suggest that bruxism is a contraindication for esthetic restorations, such as microveneers, laminates, and facets. Bruxism is the non-functional clenching or grinding of the teeth that may occur during sleep or less commonly in daytime, is the most common parafunctional activie of TMJ.\(^{16}\) The success rates of indirect esthetic treatments in patients with bruxism are variable, and the causes of reported failure are usually the cracks, fractures, or detachment of the restoration. In such cases, meticulous planning has to be done, including the preparation of restorations in respect to the occlusal principles, and at the same time soften the impact of bruxism through a bite stabilizing plate.\(^{17}\)

The aim of this study is to present a clinical case of an esthetic and functional rehabilitation, previously planned and virtually built through DSD, on a patient with parafunctional habit.

**Case Report**

A 21-year-old female complained of loss of shape, size, and proportion of an anterior teeth due to wear caused by bruxism and darkening restorations of composite resin (canine to canine). The clinical examination evaluated the patient, observing her face, smile, gingival contour, and psychological profile, complemented by radiographic examinations and photographs. The frontal photographs of the face were manipulated to analyze the vertical and horizontal lines; the dental display through of the lips parted [Figure 1a], the height and width of the smile of the teeth at maximum habitual intercuspation, the positioning and symmetry between the anterior teeth; small details, such as texture, marginal ridges and areas of translucency; and lateral photographs to assess posterior teeth exposure in dynamic vision and dental contours.

After the clinical, radiographic and photographic examinations and taking into consideration the patients complaint, the treatment plan were made for the preparation of microveneers canine to canine (except the left central incisor, the tooth had endodontic treatment with darkening coronary, requiring more wear during preparation, so have prepared for laminates), including gingivoplasty in the pre-molars area.

The DSD performed to the patient made it possible to expose the smile design and present the patient with her initial photos, comparing them with the edited photos, which showed the changes that needed to be made in her smile [Figure 1b]. DSD showed a need not only to reestablish the cervicoincisal size of its teeth but also the proportion of it (in the mesiodistal sense) and the need for gingivoplasty to correct the esthetic rose of the buccal corridor, which was descending.

It was also possible to detect the need of whitening those teeth before preparation for the laminates so that they could also choose a lighter color for esthetic restorations. The use of stabilizing plate was stipulated after esthetic rehabilitative treatment as therapy to be followed strictly. After approval of the treatment plan, the patient was advised to use the stabilizer plate in the determined regimen; and the next steps for waxing process were started.

The impression of the upper and lower arc was made using putty (Zetalabor, Zhermack, Badia Polesine, RO, Italy) and light (Oranwash, Zhermack, Badia Polesine, RO, Italy) condensation silicone at the simultaneous technique. The impressions obtained were sent to the laboratory along with photographs, DSD, and patient wishes, to the construction of the wax-up.

The mock-up was made through the impression of wax-up using putty condensation silicone (Zetalplus, Zhermack, Badia Polesine, RO, Italy). The mock-up was filled with bis-acryl resin (Protemp, 3M ESPE, Sumaré, SP, Brazil) color A2 and positioned on the teeth until the material had completed its polymerization. The mock-up was removed using a scalpel to cut the excess material. After, the bis-acrylic resin mock-up was finished and polished with aluminum oxide discs, felt disks with polishing paste [Figure 1c].

The phonetic test was performed, and new photos were taken, with the mock-up in position, serving as a comparison for the patient to note the differences of before and after. Using these simulation methods of the final restoration, the patient approved the treatment plan, and then, the rehabilitation was started.

On the same day of the esthetic test, a clinical crown augmentation surgery was performed with the purpose of remodeling the gingival contour to restore an adequate anatomical shape, brighter, reestablishing a new biological space, through new gingival margin surgically made, facilitating restoration hygiene [Figure 2a].

Dental whitening was performed 30 days after periodontal surgery. A laser whitening session (Whitening Lase II, DMC Equipamentos, São Carlos, SP, Brazil) was performed, which is a specific equipment for dental clinic whitening. The 35% hydrogen peroxide gel (Lase Peroxide Sensy, DMC Equipamentos, São Carlos, SP, Brazil) was manipulated in the proportion of 15 drops of peroxide for 5 drops of thickener. The mixture was made manually for 1 min. The resulting gel was applied over the buccal surface (from the second premolar to the second premolar, upper and lower) with a spatula available in the manufacturer’s whitening kit [Figure 2b]. The following

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**Figure 1:** Different angles of the patient’s smile. (a) lips parted; (b) before and after digital smile design; (c) MI teeth with mock-up
application protocol was adopted: Three laser applications of 3 min each, interspersed with 2 min rest. The hybrid whitening mode was performed, simultaneous with light-emitting diode and laser irradiation [Figure 2c].

The patient was given two (upper and lower) home whitening trays along with the bleaching agent (Whiteness 10%, FGM, Joinville, SC, Brazil) to allow the patient 30 days after the periodontal surgery to continue bleaching, a period in which the gingiva would already be healed. It was recommended to use 4 h a day for 30 days.

Approximately 60 days after crown augmentation surgery, could observe total healing of the gingiva and the esthetics obtained. The preparation of the laminates for canine to canine was started using diamond tips No. 1190F and 2135F (KG Sorensen, Cotia, SP, Brazil). The wear was restricted only in enamel, except for the left central incisor that had treated channel, and therefore, it was darker than the others, requiring, therefore, greater wear of its structure so that the restorative material would be able to mask its color [Figure 3a]. To obtain precision in the amount of wear performed on the teeth, wear guide [Figure 3b] was made. The wear guide was cut with a scalpel blade 11 in the mesiodistal direction, with a slit in the middle third that allowed to evaluate the amount of wear [Figure 3c] in the horizontal direction (vestibular wear) and vertical direction (incisal wear).

After completion of preparations, the simultaneous impression was obtained using addition silicone (Honigum/Silagum, DMG, Hamburg, Germany) with automatic manipulation of the putty silicone. The gingival retraction was performed with a retraction cord (#000, Ultrapack, Ultradent, Indaiatuba, SP, Brazil). The next step was to remove the cord and the immediate placement of the light material on the preparations and in the tray previously loaded with putty material, finalizing the process [Figure 4a].

The color selection was made, choosing 1M1 color [Figure 4b]. For the preparation of the provisional, the mock-up was filled with bis-acrylic resin (Protemp, 3M ESPE, Sumaré, SP, Brazil), in color A2.

In addition to the waxed model and working template, the photographs of the color selection were sent to laboratory to reinforced the morphological characteristics of the patient and to guide the better form of teeth. The restorative material of choice for the preparation of the prostheses was injected lithium disilicate (IPS e.max, Ivoclar Vivadent, Barueri, SP, Brazil).

When the prosthetic parts were finished [Figure 5a], the patient returned to the clinic, the temporary restorations removed and after prophylaxis with pumice and soft brush was performed, and the pieces were positioned to be evaluated (dry proof).

The cement selected for this case was photopolymerizable cement (Variolink Veneer, Ivoclar Vivadent, Barueri, SP, Brazil). The restorations were then tested with try-in for cement color selection (Try-In Paste, Ivoclar Vivadent, Barueri, SP, Brazil); the chosen color was a +1.

The cementation protocol had the following sequences: The ceramic restorations were prepared with 10% hydrofluoric acid (Condac Porcelana, FGM, Joinville, SC, Brazil) for 20 s and rinsed with air-water spray, and then, 37% phosphoric acid was applied (Ultra-Etch, Ultradent, Indaiatuba, SP, Brazil) rubbing the internal surface of restorations for 1 min, rinsed with air-water spray, and dried; then, the silane bonding agent (Monobond N, Ivoclar Vivadent, Barueri, SP, Brazil) was applied on the internal surface of restorations for 1 min, followed by hot air for 2 min. The teeth were submitted to prophylaxis with pumice-water slurry, and the teeth adjacent to the cementation were protected with isolation tape (Isotope, TDV, Pomerode, SC, Brazil). Thereafter, the teeth were etched with 37% phosphoric acid (Condac, FGM, Joinville, SC, Brazil) for 15 s in dentin and rinsed with air-water spray with caution to avoid surface dehydration, and then, the adhesive was applied (Excite F
DSC, Ivoclar Vivadent, Barueri, SP, Brazil) on the acid-etched surface followed by application of air to eliminate the solvent without promoting light curing. After application of cement (Variolink Veneer, Ivoclar Vivadent, Barueri, SP, Brazil) on the restoration, it was put in position and the excess material was removed, followed by light curing for 40 s on each tooth surface.

The restorative procedure was completed with occlusal adjustments in IM, and left and the right protrusion and laterality movements were performed with 3118F diamond tip (KG Sorensen, Cotia, SP, Brazil). The polishing of the adjusted regions occurred with abrasive rubbers (Dhpro, Paranagua, PR, Brazil). At the end of the restoration process, immediate esthetic resolution and patient satisfaction were obtained [Figure 5b] and the comparisons between before and after treatment reinforce this statement [Figure 5c].

Knowing that the patient has bruxism, a stabilizing plate for nocturnal use has been made [Figure 6a], being a possible treatment for this type of temporomandibular disorder, with the functions the relaxation of the muscles involved in bruxism, can be reducing pressure on the TMJ, and protecting the teeth from attrition and wear. [26,19] The adjustment of the plate with the use of double-sided carbon (Detecto, Dentsply, York, PA, USA) and No. 8 straight drills was performed through selective wear to determine the correct distribution of MI contact points, canine guide, and protrusion, conferring a bilateral balanced occlusion. The patient was advised on the use of the stabilizing plate, recommending the nocturnal use, and daytime use just in stressful situations [Figure 6b].

A year after the conclusion of the case, the patient returned to a follow-up appointment, there were no complaints and the clinical examination indicated normality, and the case was successful until then.

**Discussion**

The concept of minimally invasive dentistry has become a clinical reality, and this is mainly due to the technological development applied to new materials and adhesive techniques. However, the success is only achieved when a scientifically based clinical protocol is considered, respecting the technical sensitivity and characteristics of the adhesive systems, the ceramic systems, and their surface treatment and the knowledge of resin cements. Allied to the technical knowledge of the materials and techniques, the clinical perception for the other components that lead to the esthetic-functional balance must be observed, to obtain, at the end, restorations that fulfill their esthetic, biological, and functional aspects. [20]

Historically, the concept of ceramic laminates without tooth surface wear, comes from to 1930, when a California dentist that worked at the movies, improved esthetically the smile of some artists with an adhesive aid for the temporary fixation of full dentures. [21] From the technique of acid etching of the enamel introduced by Buonocore in 1955, materials for adhesion to dental structures have undergone constant improvement. [22] In 1980, with the development of new adhesive cementation techniques, ultrafine laminates and their use became gradually established in the so-called minimally invasive dentistry, a concept in which the restorations created cause little damage to the dental structure. [23,24]

Restorations planned involving the concepts of micro and macro esthetics and following the patient perceptions, may have great chances of promoting more predictable clinical results. As it was said, DSD is a great tool that helps planning, presentation of the case to the patient, waxing, confection of the mock-up, and application of possible corrections of the previously established dental drawing. In this tool, the interventions to be performed, both in the esthetic white and pink esthetics, can be predicted and presented to the patient. Thus, in esthetic rehabilitation, DSD is an important tool between the patient, the dentist, and prosthetic dental. [2,10,13]

Pre-restorative interventions may be required during the planning of esthetic restorative treatment. Dental bleaching, whether in the office or supervised, can promote significant changes in the chroma of whitened teeth and is seen as an effective option to promote the balance of the color of the remaining teeth with the new ceramic restorations. [25] Interventions in the pink esthetics, in the periodontium, are commonly required and involve the planning of periodontal plastic surgeries, such as gingival grafts, increase of clinical crown to restore biological distance or gingivoplasty, as in the present case. [26]
In the present case, the patient complained about the frequent staining of composite resin restorations. Indirect restorations were made because ceramic systems have good properties, such as biocompatibility, mechanical properties, color stability, resistance to wear and surface roughness, allowing the maintenance of periodontal health and offering optical properties similar to the dental tissues.[27-29]

During the execution of the minimally invasive dental preparations, the wear guide can be obtained from the mock-up, granting the selective reduction of the enamel and ensures that the restorative treatment is successful with respect to the corrections of color, shape, and position. In addition, the wear guide allows better precision in the teeth preparation.[30]

The cementing protocol used in this case involved current concepts of adhesive cementation. The choice of photopolymerizable cement was due to the thickness of the restoration used, which allowed the adequate passage of light and clinical characteristics such as the prolongation of working time, ease of removal of excesses, and color stability of these cements. The chemically activated cements and duals present the tertiary amine as a chemical activator, which can cause color changes over time, compromising the esthetic result.[31] The choice of cement color was due to the use of test slides. Recent studies have shown a strong correlation between the color of the cement and the try-in paste.[32,33]

However, studies involved materials considered of excellence for cosmetic treatments, and this statement cannot be generalized to all cements available in the market. The option for cement with a higher value was based on the color instability of the transparent pastes.[34]

In addition to the conscious choice of cement, the chosen light curing device (1,200 mW/cm²) was able to promote a satisfactory polymerization. Inadequate polymerization could lead to marginal microleakage due to adhesive failure and reduction in physical properties and mechanical.[35]

Another important aspect is that the patient presents bruxism, which means a relative contraindication for esthetic restorations. The presence of the tightening imposes the use of mechanisms to allow greater longevity to the restorations teeth, and the use of the bite stabilizing plate is an important therapeutic measure to avoid the fracture of the ceramics.[17]

Although follow-up studies of restorations performed with lithium disilicate are scarce in the literature, this treatment option is safe because conventional lithium disilicate has proved to be effective and reliable in the short-to-medium term. The choice of this material may represent a valid option in many clinical situations, offering biological, technical, and esthetic advantages.[36,37]

**Conclusion**

It is concluded that the DSD, along with other auxiliary examinations, such as radiography, digital photographs, gypsum model, and mock-up, is indispensable tools for minimally invasive dentistry that requires the dental surgeon a meticulous and perfectionist job. However, knowledge of the materials, adhesive techniques, and biomechanical principles of indirect esthetic restorations is critical to clinical success. Lithium disilicate ceramics are an excellent restorative option; however, for patients with bruxism, the use of the bite stabilizer plate is necessary.

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