Digital planning associated with periodontal surgery for aesthetic resolution

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Introduction: The Digital Smile Design (DSD) is a relevant tool in prosthetic planning, allowing to predict modifications desired by the patient, guiding surgeries and contributing to the final treatment outcome. The ceramic veneers stand out for the ability to mimic the dental characteristics, presenting excellent longevity, color stability and minimal wear of tooth structure. **Objectives:** The objective of the present study was to present a clinical case with interdisciplinary procedures and planning with digital techniques to improve communication between dentist, patient and laboratory, allowing to predict treatment outcomes. **Results:** Facial and dental analysis techniques were applied to establish the planning of periodontal approach, selection of restorative material and the preparation to be performed. The treatment of the present oral rehabilitation was supported on a careful sequence of the execution protocol, mainly regarding the stages of aesthetic evaluation, in order to meet the expectations of the professional and patient in order to reach a successful result. **Conclusion:** The conclusion of the clinical case shows that the tools used to establish the diagnosis and planning together with careful protocol of the clinical stages allows obtaining excellent esthetics and restoration of oral health. **Keywords:** Esthetics, dental. Periodontics. Ceramics.

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» Patients displayed in this article previously approved the use of their facial and intraoral photographs.

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INTRODUCTION

The concept of esthetics is related to the cultural, temporal and emotional values of each individual. Thus, the perception of beauty is individual and intimate. To achieve the esthetic standard in Dentistry, patients' expectations should be carefully known to diagnose any elements that they consider unpleasant and exhibit disharmony.[1]

The establishment of diagnosis in Dentistry by observation of the facial features, smile and teeth should consider the aspects that comprise the macroesthetics and microesthetics. The aspects observed on the face, facial and dental midline, tooth axes and papillae, incisal plane, dental and periodontal proportion, i.e. the interrelation between face, gingiva and teeth, are aspects analyzed in macroesthetics. Conversely, the singularity of the tooth, such as shape, contour, size, texture and optical properties, constitute the microesthetics. The combined evaluation of these aspects and their importance in the hierarchy of beauty indicators guide the changes to be achieved by the esthetic rehabilitative treatment.[2-4]

The collection and evaluation of these elements are achieved through anamnesis, clinical examination, imaging examinations and dental casts. However, tools as photographs, videos and presentation software have been increasingly used to refine this evaluation, providing a sophisticated resolution for esthetic rehabilitative treatments.The Digital Smile Design (DSD) aided by a photographic protocol is a relevant tool for the planning of changes desired by the patient, contributing to predict the final outcome, facilitating the guidelines to the laboratory, guiding the preparation to be performed and finally enhancing the communication between professional and patient, constituting an outstanding method for virtual presentation of the proposed treatment.[5]

Considering the diverse restorative techniques that may be used to achieve harmony and oral health, the laminate veneers stand out for their capacity to mimic dental characteristics, excellent longevity, shade stability and minimal wear of tooth structure. Thus, this material became the most suitable for utilization in restorative dentistry and is indicated for alterations of contour and shape, size, proportion, position, correction of diastemas and reestablishment of occlusion guides.[6]

The periodontal biotype is part of the successful treatment of pink esthetics. After correct diagnosis, followed by adequate treatment planning, its influence on the white esthetics enhances the harmony of smile. The gingival health should be evaluated before treatment. Gingival exposure during smiling, buccal corridor, smile curvature and incisor exposure at rest are important factors to determine the adequate treatment planning to achieve success in both white and pink esthetics.[7]

Thus, this paper presents a case report addressing the Digital Smile Design technique (DSD). The paper presents the stages of rehabilitative esthetic treatment – digital planning, periodontal surgery and sequence of preparations, impression and cementation of all ceram restorations.

RESULT

Patient GDS, female, 48-years-old, searched for dental treatment with complaint about the smile esthetics and discoloration of composite resin restorations on the anterior teeth. A detailed anamnesis of the patient's general health was initially performed, followed by evaluation of oral health. A closer view revealed dissatisfacto-

ry composite resin restorations in the maxillary anterior segment, diastema between the maxillary right and left central incisors, short clinical crown and gingival smile. The palatal aspects of anterior teeth did not present carious lesions or restorations. However, teeth in the mandibular anterior region presented loss of structure due to attrition, without restorations or carious lesions (Fig 1). Since there were no alterations that might impair the treatment, lateral, frontal and smiling photographs were obtained for treatment onset (Fig 2). Following, impressions were obtained of the maxillary and mandibular dental arches using addition silicone (Express XT - 3M ESPE, Sumaré, SP, Brazil).

The DSD was applied to assess the bipupilar line, used to establish the horizontal plane, and the midline was delineated according to the facial characteristics and anatomical points of the patient (Fig 3). Thereafter, the smile was assessed by transposition of the maxillary arch on the smiling photograph, thus allowing evaluation of the lip limit outline in relation to the teeth arrangement. The simulation of smile was performed by tracing three reference lines: the first was traced from one canine tip to the contralateral canine tip, the second between the midpoints on the incisal edges of both central incisors, and the third on the dental midline, from the tip of the interdental papilla between the central incisors to their incisal edge (Fig 4). Finally, the dental proportions were analyzed using a digital ruler, calibrated by an intraoral photograph, by measuring the length of on central incisor on the dental cast and transferring this measurement to the computer (Fig 5).

The dental casts, together with the photographs, the DSD and guidelines for esthetic mock-up were sent to the technician, who was asked to perform the wax mock-up according to the planned changes (Fig 6). The silicone guide used to fabricate the mock-up and the preparation guides were fabricated using condensation silicone (Zetaplus, Zhermack, Badia Polesine, RO, Italy) over the wax mock-up. The esthetic mock-up was made with bis-acryl resin (Structur, Voco, Porto Alegre, RS, Brazil) to evaluate the characteristics of contour, size, proportion and relationship with the periodontium (Fig 7). It should be highlighted that, among the instructions provided to the technician, it was asked to perform waxing of the cervical region over the gingiva on the dental cast, at the proportion planned on the DSD. After evaluating the predicted outcome as demonstrated by the esthetic mock-up, both patient and professionals were satisfied and confident in the result to be reached.

Figure 1: Initial intraoral aspect of smile.

Figure 2: Frontal and lateral photographs of the patient for analysis of facial esthetics.

Figure 3: Frontal photograph with identification of midline and bipupilar line.

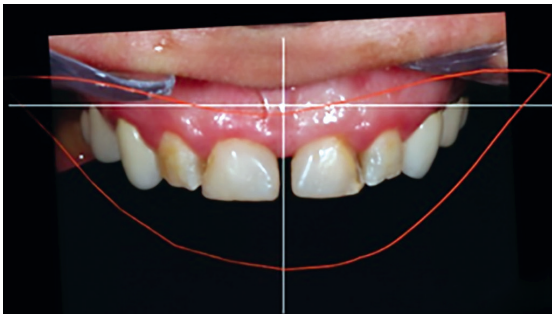

Figure 4: Photograph of maxillary arch with grouped lines for drawing on dental surfaces.

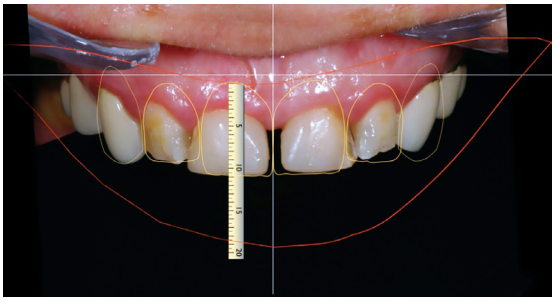

Figure 5: Analysis of dental proportions using the digital ruler.

Figure 6: Facial aspect of the patient illustrating the virtual planning performed.

Figure 7: Aspect of esthetic mock-up performed.

Thus, the mock-up was used as a guide for periodontal surgery. The patient was anesthetized with the bis-acryl resin in place, in which the gingiva was delineated by contouring the cervical margin of the guide using a blade n. 15c (Free Bac, Embramac, Campinas, SP, Brazil), to draw the new gingival position and contour (Fig 8).

After periodontal surgical mapping, the guide was removed using a Hollenback carver (Duflex, Rio de Janeiro, RJ, Brazil) and internal bevel incisions were made at a 45° angle, and intrasulcular incisions using a blade n. 15c (Free Bac, Embramac, Campinas, SP, Brazil) to release the gingival marginal collar.

Using a Kirkland knife (Hu-Friedy, Chicago, IL, United States), the excess gingiva was removed, increasing the size of the clinical crown. During probing, a 2-mm distance was observed between the alveolar bone crest and the cementoenamel junction, and a full thickness flap was then raised for osteotomy, osteoplasty and delineation of the gingival zenith (Figs 9 and 10). The bone removal allowed an increase in space to 3 mm, which was sufficient for re-adaptation of biological dimensions (Fig 11). At completion of the procedure, the area was covered with periodontal dressing for seven days. Analgesic medication was prescribed (dipyrone 50mg), even though the patient did not report pain in the postoperative period.

An approximate period of 90 days was allowed for periodontal recovery, then the teeth were prepared using diamond bur 4138 (KG Sorensen, Cotia, SP, Brazil) and a preparation guide fabricated with condensation silicone (Zetalabor, Zhermack, Badia Polesine, RO, Italy), for rounding and surface leveling. During preparations, the inclinations and depth were respected, providing the necessary space for adaptation of ceramic veneers planned in DSD and assessed by the preparation guides fabricated on the waxed model. Since composite resin restorations were present in all anterior teeth, wear of approximately 1.2 mm was made, thus precluding the maintenance of preparation in enamel. Therefore, it was decided to perform a slightly subgingival preparation (0.5 mm), also because of the shade difference between tooth substrate and ceramic. The cervical preparation employed the same thickness of wear, since this region exhibited significant shade difference between tooth substrate and ceramics (Fig 12).

After completion of preparations, two-stage impression was obtained by the double cord technique, retracing the gingiva using two retraction cords (#000 and #00 - Ultrapak, Ultradent, Indaiatuba, SP, Brazil), selected after probing the prepared teeth. The thinner cord was used first, soaked in aluminum chloride hemostatic solution (Hemostop, Dentsply, Petrópolis, RJ, Brazil) for bleeding control. The second cord was inserted without hemostatic solution for horizontal retraction of the margin. The second cord was removed, and the first cord was entrapped in the addition silicone impression (Express XT, 3M ESPE, Sumaré, SP, Brazil). The light and putty materials were used in distinct stages, beginning by impression with putty silicone and, after relief, the impression was refined using extra light addition silicone (Fig 13). At completion of impression, the shade was selected using the scale 3D Vita Master (Vita, Bad Sackingen, BW, Germany), recorded by photography and then sent to the technician, together with the impression achieved. Provisional restorations were performed after shade selection, using the same silicone guide employed for the esthetic mock-up, with bis-acryl resin.

Figure 8: Utilization of mock-up for surgical-periodontal mapping.

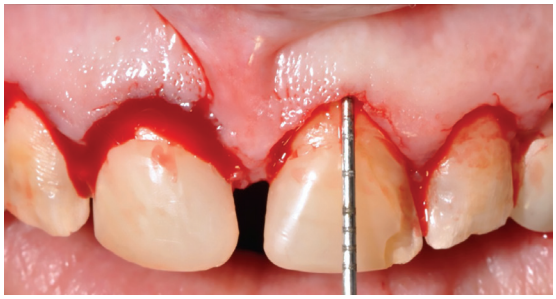

Figure 9: Probing for evaluation of sulcus dimensions.

Figure 10: Flap raised for osteotomy.

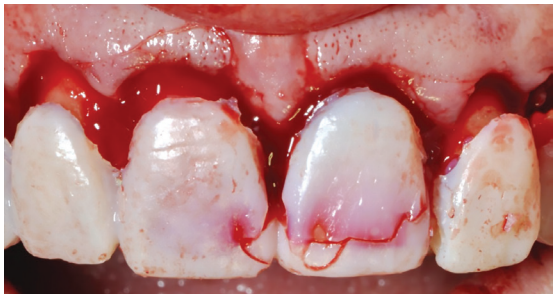

Figure 11: Mock-up in place to evaluate the biological space achieved after gingivoplasty.

Figure 12: Teeth prepared for laminate veneers and metal-free full crown.

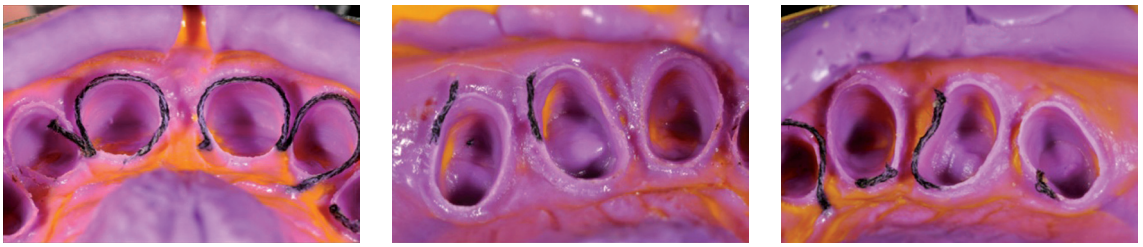

Figure 13: Impression achieved with addition silicone.

The laminate veneers and metal-free crowns were fabricated using lithium disilicate (E-max press, Ivoclar Vivadent, Barueri, SP, Brazil) and, after evaluation of adaptation and esthetics, the restorations were cemented using resin cement (Variolink II, Ivoclar Vivadent, Barueri, SP, Brazil). Dry fitting of the restorations was initially performed to check the adaptation, followed by shade selection of the luting agent using try-in pastes (Ivoclar Vivadent, Barueri, SP, Brazil). The cementation protocol had the following sequence: the ceramic restorations were prepared with 10% hydrofluoric acid (Condac Porcelana, FGM, Joinville, SC, Brazil) for 20 seconds, rinsed with air-water spray, and then 37% phosphoric acid was applied (Condac, FGM, Joinville, SC, Brazil) rubbing the internal surface of restorations for one minute, 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 one minute, followed by hot air for 2 minutes. Thereafter, the teeth were etched with 37% phosphoric acid (Condac, FGM, Joinville, SC, Brazil) for 15 seconds in dentin, rinsed with air-water spray with caution to avoid surface dehydration, and then the adhesive was applied (Excite F DSC, Ivoclar Vivadente, 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 on the restoration, it was put in position and the excess material was removed, followed by light curing for 40 seconds on each tooth surface. After placement, the occlusion was adjusted and smiling frontal and lateral photographs were obtained for analysis of ceramic restorations (Figs 14, 15 and 16). The pre- and post-operative photographs were placed side by side for comparison (Fig 17). After treatment completion, the patient stated she was satisfied with the outcome, which enhanced her self-esteem.

Figure 14: Image after placement of ceramic restorations.

Figure 15: Lateral photograph of the patient's smile after treatment completion.

Figure 16: Frontal and lateral photographs of the patient after placement of ceramic restorations.

Figure 17: Comparative photograph before and after esthetic rehabilitative treatment.

DISCUSSION

Software for digital planning are an increasingly important communication tool between dentists, technicians and patients.[8] The DSD redesigns the pink and white esthetics, identifying the negative aspects that may be altered and providing a prediction of the final outcome, aiding the professional to determine the treatment planning.

The fundamental aspects behind the digital procedures are related to photographic evaluation. The digital manipulation of these images enhances the understanding of the relationship between teeth, gingiva, face and emotional aspects, in a dynamic manner and with more details than conventional planning, since it enhances the visualization of problems and allows virtual construction of different of different rehabilitative projects that should be timely discussed and presented to the patient.

Ideally, the patient's smile line should allow visualization of up to 3 mm of gingiva in symmetric harmony with the gingival margin. The smile is considered to be gingival when more than 3 mm of gingiva are seen during a moderate smile.[9] The etiology of gingival smile is varied, and the literature reports possible causes, as maxillary vertical excess, greater muscular ability to lift the upper lip when smiling, increased space between the lips at rest, increased overbite and overjet, besides short upper lip and short clinical crown, which when combined may contribute to the gingival exposure.[10,11]

Several therapeutic options have been suggested for the gingival smile, according to its etiology. In case of gingival smile caused by excess gingival tissue partly covering the anatomical tooth crowns (also caused by altered passive eruption), gingival resection has been suggested (gingivoplasty).[12-14]

Gingivoplasty was indicated in this case considering the need to remove a band of excessive keratinized gingival tissue and to optimize the restorative procedures. The height and contour of margin incisions was guided by digital planning, allowing greater accuracy of measurements as compared to conventional planning. Since the distance between the alveolar bone crest and the cementoenamel junction was not sufficient to create a biological dimension that would allow connective attachment, a full thickness flap was raised, followed by osteotomy for bone remodeling, finalized by flap repositioning and suture, in order to allow reestablishment of adequate biological dimension for the prosthetic work.

Maintenance of biological dimensions of the supracrestal gingival tissues is paramount for periodontal health.[16] The biological space is the distance between the most coronal portion of the junctional epithelium up to the alveolar bone crest, determining a minimum distance of 3 mm from the preparation to the bone crest.[17,18] The failure to respect these dimensions in restorative procedures may cause important periodontal disorders, such as gingival retraction, formation of pockets and increased gingival bleeding index.[19,20]

The success of esthetic treatments employing fixed dentures depends on the diagnosis, planning and selection of the type of material to be used. The insufficient tooth wear does not provide sufficient space for the ceramic veneer, causing cohesive and adhesive failures that lead to restoration fracture, while the excess tooth wear removes areas of enamel, reducing the adhesion of ceramics.[21] Thus, control of the extent of tooth wear is fundamental during planning using vitreous ceramics. The virtual planning allows fabrication of preparation guides, for rational control of planned wears and additions, enhancing the accuracy of preparation.

Vitreous lithium disilicate ceramics are the best choice for restorations in anterior teeth using laminate veneers and contact lenses, since they present flexural strength between 300 to 400 MPa and success rate around 99%.[22] Adhesive cementation provides greater strength without interfering with the reflection of light, restoration shade and periodontal health. Selection of the cement directly interferes with the shade of ceramic restorations, treatment longevity, marginal adaptation and strength, and the type of ceramics and clinical case should be considered for a satisfactory outcome. For vitreous ceramic systems, the resin cements are selected according to the thickness of each ceramic restoration, being that thin ceramics with thickness between 0.5 to 1.0 mm are cemented with light cured resin cement, while ceramics with thickness of 1.0 to 3.0 mm are cemented using dual resin cement .[23]

CONCLUSION

Digital photographic systems as the DSD allow predictability of the final outcome and transfer the clinical characteristics to the technician, enhancing his work and avoiding mistakes. The procedures become more dynamic, closer to reality, and minimize the repetition of stages as compared to conventional planning. The digital planning further allowed effective communication with the patient, presenting the proposed changes, and guided the waxing according to the case delineation. Waxing guided the periodontal surgery, providing a design similar to that planned in the DSD.

The case report of esthetic rehabilitative treatment using laminate veneers allowed smile correction with minimum wear and greater efficiency, thanks to the high quality of reproduction of the natural tooth appearance, better adaptation and greater longevity, leading to treatment success and increasing the patient's self-esteem. The multidisciplinary interaction between periodontology and prosthodontics provided better harmony in the esthetic outcome.

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