CASE REPORT / *CAS CLINIQUE*

Prosthodontics / *Prothèse Fixée*

CREATING SMILES WITH DIGITAL WORKFLOW AND MATRIX TRANSFER TECHNIQUE IN CUSTOMIZING PERSONALITY-BASED SMILE DESIGNING

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Introduction: This report is a presentation of a clinical case that follows the Visagism concept for 2D planning and, CAD (Exo CAD) for3D desiging along 3D printed diagnostic wax-up model for closure of anterior spacing.

Case presentation: A 24-year-old man presented with midline diastema and anterior spacing 11-13, 21-23 and wants a smile designed. This concern was solved following a smile design (VisagiSMile) planning digitally for diagnostic wax and printing a 3D model. The matrixtransfer technique has been used to directly convey planned information from 3D-printed diagnostic wax-up to definitive restorations.

Conclusions: In this day and age, cosmetics and aesthetics are moreimportant than ever. Everyone wants to have a great smile. The smile design has been made quite simple by DSD, which offers multiple benefits but also some drawbacks. The notion of a digital smile is a useful tool for visually expressing the patient's problem. In addition to benefiting patients in visualising their treatment results, it enhances clinical diagnosis and planning.

Keywords: 2D smile design, Visagism, Digital planning, 3Dprinter, CAD CAM,Matrix transfer technique.

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The authors declare no conflicts of interest.

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CRÉATION DE SOURIRES AVEC UN FLUX DE TRAVAIL NUMÉRIQUE ET UNE TECHNIQUE DE TRANSFERT DE MATRICE POUR PERSONNALISER LA CONCEPTION DE SOURIRE BASÉE SUR LA PERSONNALITÉ

Introduction: Ce rapport est une présentation d'un cas clinique qui suit le concept Visagism pour la planification 2D et la CAO (Exo CAD) pour la conception 3D, le long d'un modèle de cire de diagnostic imprimé en 3D, pour la fermeture de l'espacement antérieur.

Présentation du cas: Un homme de 24 ans présente un diastème médian et un espacement antérieur de 11-13, 21-23 et souhaite un sourire conçue. Ce problème a été résolu grâce à une conception de sourire (VisagiSMile) planifiant numériquement une cire de diagnostic et imprimant un modèle 3D. La technique de transfert matriciel a été utilisée pour transmettre directement les informations planifiées depuis le wax-up diagnostique imprimé en 3D jusqu'aux restaurations définitives.

Conclusions: De nos jours, l'esthétique est plus importante que jamais. Tout le monde veut avoir un beau sourire. La conception du sourire a été rendue assez simple par DSD, ce qui offre de multiples avantages mais aussi quelques inconvénients. La notion de sourire numérique est un outil utile pour exprimer visuellement le problème du patient. En plus de permettre aux patients de visualiser les résultats de leur traitement, il améliore le diagnostic et la planification cliniques.

Mots clés: Conception de sourire 2D, Visagisme, Planification numérique, Imprimante 3D, CAD CAM, Technique de transfert matriciel.

Introduction

Smile designing is a field of cosmetic dentistry that fixes dental flaws and improves a person's look. Today, Digital Smile Design (DSD) is revolutionizing dental care around the globe [1]. The way modern dentistry is practiced has changed completely, revolutionizing smile design clinics all over the world. Software called DSD, which is utilized based on software analysis and certain images. DSD is a tool (software) that makes it simple for patients, dental laboratory technicians, and all smile designers to communicate with one another and with one another's clients. DSD may be employed in a multidisciplinary approach and is thus applied in other areas of dentistry, such as orthodontics, periodontics, etc., in addition to prosthetic rehabilitation.

Several excellent DSD (Digital Smile Design) software alternatives exist, including Planmeca Romexis® Smile Design, Smile Designer Pro, and DSD 2D. These techniques, however, do not completely use the Visagism principle, leading to a more harmonious smile design in relation to the patient's face type and personality. It is wise to use the "Visagism" approach while creating a unique grin. Visagism involves the creation of a customized personal image that expresses a person's sense of identity. The method used to apply this concept is derived from associating the principles of artistic visual language with disciplines such as psychology, neurobiology, anthropology, and sociology [2]. Visagism allows determining which emotions and personality traits patients wish to express through their appearance and, specific to dentistry, through their smile. Visagism applied in aesthetic dentistry is associated with the assessment of the facial type, which usually involves subjective judgment, time-consuming personality tests and complex calculations of the teeth configuration. The idea of "Visagism" can aid dentists in doing restorations that align with the created image's psychological aspects, which impact the patient's emotions, identity, behavior, confidence, and aesthetic qualities. On the other hand, these variables influence how patients respond to a certain treatment. The dental software "VisagiSMile" recently included the Visagism idea to assist dentists in customizing and enhancing smile designs [3].

Case report:

Figure 1. Extra oral image.

Figure 2. Extra oral image with retractors.

A 24-year-old patient presented to our Department of Prosthodontics at Sharad Pawar Dental College, complaining of anterior spacing and requesting smile improvement. On intra-oral examination, midline diastema and spacing between lateral and canine on both sides of the maxillary arch are seen. A lack of overbite has been observed. Normal frenal attachment with uneven gingival marginal levels has been observed on soft tissue examination. A diagnostic wax-up based on digital technology was utilized to investigate possible aesthetic enhancement using the procedure described below. During the initial clinical appointment, extraoral pictures and videos were obtained from the right and left frontal and lateral facial positions and the lower third of theface when it was at rest, smiling, and while the lips were closed [4] (Figure 1). A diagnostic impression of both arches was made with an alginate impression materials (Dentsply Sirona -Zelgan Advanced). Diagnostic casts are obtained, which are scanned by using an extra-oral scanner (Dentsply Sirona Scanner in EosX5). Four videos were captured using an iPhone 13 pro from different estimated angles to comply with the digital smile design (DSD) dynamic documentation methodology to accomplishthe optimal development of the facially smiling frame. The following videos were taken: a frontal face video with and without retractor smiling (Figure1-3c), a profile video, a video taken at 12 o'clock, and an anterior occlusal video taken perpendicular to the occlusal plane without a mirror. Four more complementary videos are a face interview, a film of 180-degree phonetics, and an intraoral functional and structural video utilising a retractor.

In addition to a midline diastema, spacing, and an uneven gingival border level, the smile analysis revealed an imbalanced zenith position between the central incisors, canines, and occlusal embrasures of the maxillary front teeth. Any DSD software enables aesthetic designing by sketching reference lines and forms on extra- and intraoral digital pictures. VisagiSMile automatically positions the full-face shot with the widest smile and most apparent teeth in the background of the facial frame.

Figure 3. A. Intra-oral picture with midline diastema, with uneven gingival margin. B and C. Anterior spacing seen with lateral and canine bilaterally on scanned maxillary and mandibular cast using Exocad.

The program identifies the face form as powerful, dynamic, delicate, or calm after automatically analyzing the facial structure and identifying the landmark spots on the image. Reference lines are used in facial analysis to create standard parameters for the frontal aspect of the face. The facial midline, which passes the glabella, nose, and chin, is one of the vertical reference lines. The horizontal reference lines comprise the inter-commissural and inter-pupillary lines, giving the face a full feeling of balance and horizontal overview (Figures 4, 5). Additionally, the program recognizes face traits and generates a facial map; beta face API is used for picture recognition. The patient's face type is then classified using the facial map. Geometrical approximation and classification trees are the software's current two techniques of classification.

The algorithm iterates over the patient's facial features, including the mouth, eyes, nose, and brows

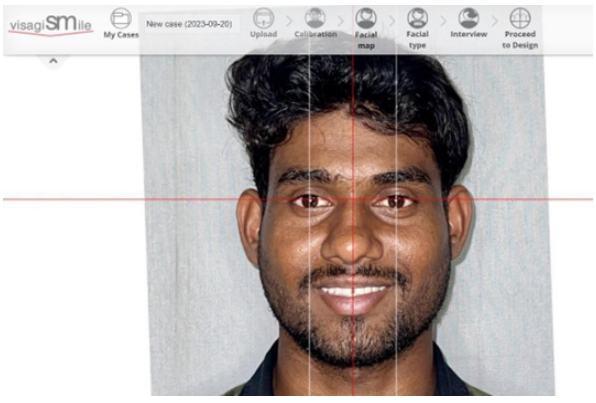

Figure 4. Vertical and horizontal reference lines.

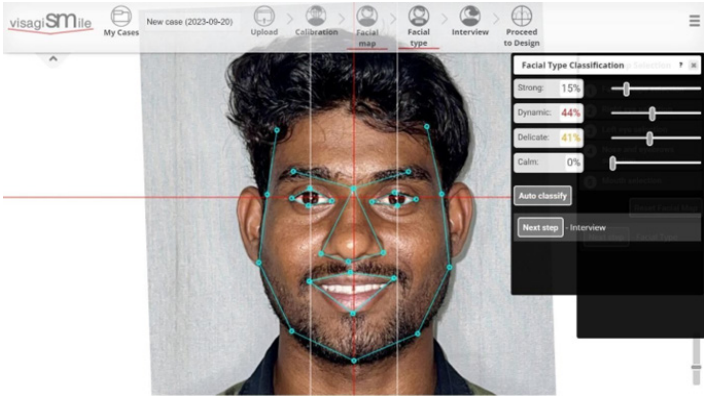

Figure 5. Facial map with landmark points and type classification.

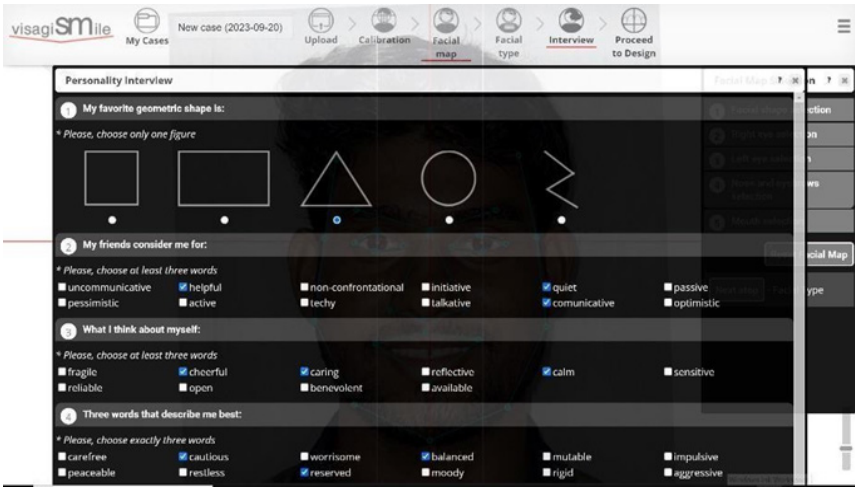

Figure 6. Personality interview.

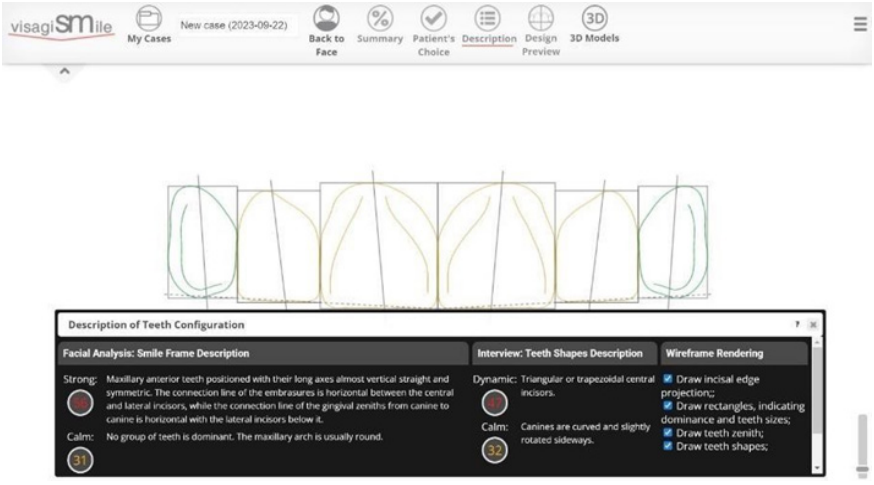

Figure 7. Final design with detailed text description analysis summery of face reading.

once the patient's photo has been uploaded and the dentist selects the facial map. It categorizes the entire face in (Figure 5) using the findings for all characteristics (15% strong, 44% dynamic, 41% delicate, 0% calm, for example). The geometrical approximation technique correctly recognized 56% of the occurrences when evaluated against test data. More examples provided to the algorithm for information extraction would further improve accuracy. An online interview using a software-generated questionnaire is used to identify the ideal tooth form (Figure 6). Based on the information from the interview, an algorithm on a computer calculates the patient's temperament, which is a mix of four types: strong, dynamic, delicate, and calm. The tooth forms that best reflect each patient's unique traits are, in order, powerful (rectangle), dynamic (triangle), delicate (circle), and serene (square). The proposed teeth configuration is calculated while taking the patient's preferences into consideration for the desired tooth design. Some of the preferences relate to the teeth form, texture, and color. The program determines the key elements of each unique grin frame based on the face analysis, including incisal projection, teeth morphologies, dental inclination, dominance, etc [5, 6]. The smile design considers the information from the interview, the facial analysis, and the patient's preference in line with the criteria of aesthetics (Figure 7).

Specific tools were used to elaborate the diagnostic wax-up. The STL file from the inlab programme was then loaded into the CAD dental software (EXOCAD programme Dentsply Sirona). A new Project was created, and an anatomic crown was selected for 11-13 to 21-23 for diagnostic wax. With the use of Exocad software, it was feasible and compatible for most of the software to overlay the planned smile design data inti it and to further procced with 3D planning for digital diagnostic wax up and virtual model on the patient's image. Once the process was finished, our virtual wax up's STL file was exported. The 2D smiling frame may be converted into an analogue (3D digital wax-up) or digital (traditional wax-up) 3D Project. After all the primary work is finished, the required adjustments are made using a digital ruler. The modifications can be adjusted to the patient's needs and aesthetic choices. A patient is shown a brand-new smile once all the changes have been made. This digital smile may develop a final model that can be visually evaluated in the patient's oral cavity. The model enables the visualization of speech during the try-in phase before any permanent changes take place, in addition to gingival architecture, lips, and face form. The STL files of diagnostic wax-up casts were used to manufacture a 3D printer. The post-processing procedures of the 3D- printed cast were carried out following the manufacturer's recommendation (Figure 8). Using the 3D-printed diagnostic wax model, a silicon putty index was made as a matrix transfer technique (MTT). Partial contour In MTTs, the intended information is often only sent in its palatal or lingual shape, or its "shell." The shell is especially helpful for upper anterior teeth since it defines the functional surfaces that do not just allow for aesthetic composite multilayer strategies. This method further for distinct smooth anatomical development of contact points. In addition, Silicone bite registration matrix (Figure 9) is utilized for hard opaque

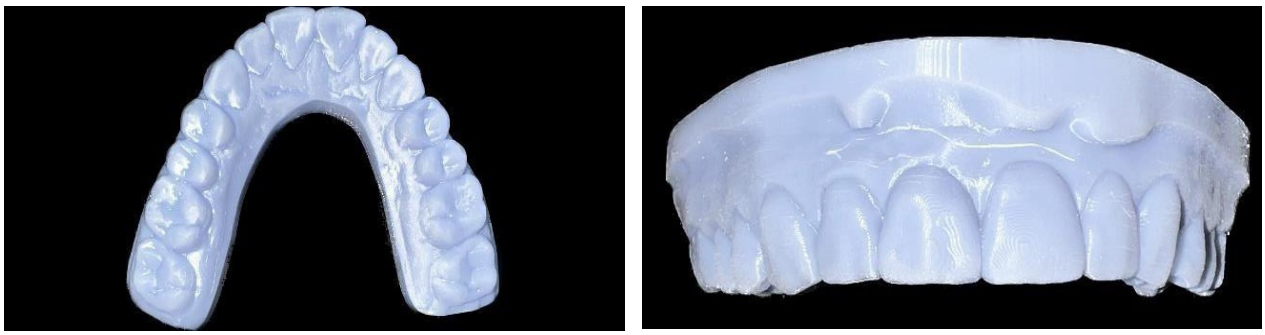

Figure 8. 3D printed diagnostic wax-up.

Figure 9. Matric silicon index.

Figure 10. Palatal shell's using partial silicone cast.

Figure 11. Post op intra and extra oral pictures smile frame.

matrix [7] for partial transfer that is light-curable from buccal, designed aesthetic shade layering. 'Shell' transfers in part, enabling layered aesthetic shades (Figure10). The use of contoured interproximal matrices along with wedge to manage gingival shape and correct centerline with a layered approach. Composite buildup is done with remaining surface along with finishing and polishing is done. Follow up is taken after 6 months (Figure 11).

Discussion

The virtual diagnostic wax-up is a simple technique for simulating theresults of the ultimate course of treatment. This report's technique combines conventional, digital, and analogue steps. Conventional impressions were taken, the digital diagnostic wax-up was created virtually, and 3D-printed castings were created utilizing AM technology (Additive manufacturing technology). However, a traditional analogue approach was attempted, utilizing a direct composite resin to bemore conservative. The Matric transfer silicone index signifies the link between the patient's mouth and the virtual diagnostic wax-up. When the mock-up calls for adjustments, the procedure may be changed. These adjustments should ideally be made in the patient's mouth. In this situation, no modifications were needed after the mock-up [8].

Video recording has been recommended since it is difficult to capture the patient's normal, sociable smile in a photo [9]. Some CAD dentistry software program offer a specific capability that enables alignment between the two-dimensional (2D) pictures and the three-dimensional (3D) virtual model when at least four landmarks have been marked [10] is based on specific photographs and software analysis. DSD is a tool (software. When doing a direct mockup (or other ideas like DSD), the dentist should use the program VisagiSMile as a reference for a personality-based design. However, the process as it is now presented improves the patient's abilityto visualize the suggested plan of treatment. Successful smile design and treatment planning need effective communication since the patient's consent is required and the treatment goals must be determined by the multidisciplinary team using technology. Digital tools tremendously facilitate and enhance this bidirectional flow of communication.

Conclusion

In this day and age, cosmetics and aesthetics are more important than ever. Everyone wants to look good and have a great smile. The smile design has been made quite simple by DSD, which offers multiple benefits but also some drawbacks. The notion of a digital smile is a useful tool for visually expressing the patient's problem. In addition to benefiting patients in visualizing their treatment results, it enhances clinical diagnosis and planning. The extraoral photographs and video documentation were the first steps in the report's digital workflow. Next, "VisagiSMile," which enables dentists to customize and enhance the smile design of the faciallygenerated diagnostic digital wax-up, a Exocad designed and 3D-printed diagnostic wax-up with a diagnostic mock-up that eliminated the need for traditionally manufactured wax-ups, was presented.

References

1. Davis NC. Smile Design. Dental Clinics of North America. 2007 Apr;51(2):299–318.
2. PHILIP HALLAWELL. Visagismo: Harmony and Aesthetics [Internet]. 6th ed. SENAC SÃO PAULO EDITORA; 2003. Available from: https://visagismo.com.br/visagismo-harmonia-e-estetica
3. Braulio Paolucci, DDS, Marcelo Calamita, DDS, MS, PhD, Christian Coachman, DDS, CDT Galip Gürel, DDS, MS Adriano Shayder, CDT Philip Hallawell. Visagism: The Art of Dental Composition [Internet]. Digitalsmiledesign.com. 2012 [cited November 11, 2022]. Available in: https://digitalsmiledesign.com/files/Old-Website-Assets/Media/Paolucci_Visagism_QDT.pdf.
4. Marta Revilla-León,José Luis Sánchez-Rubio,Adriana Besné-Torre,Mutlu Özcan. A-report-on-a-diagnostic-digital-workflow-for-esthetic-dental-rehabilitation-using-additive-manufacturing-technologies. The International Journal of Esthetic Dentistry. 2018;13(2).
5. Iliev G. Personalized digital smile design for predictable aesthetic results. Balkan J Dent Med. 2016;20(3):172–7.
6. Proportional Ratios between Widths, Heights and Areas of Maxillary Frontal Teeth. International Dental Journal [Internet]. 2016;1(66). Available from: https://byankov.com/wp-content/uploads/2019/01/VisagiSMile-Dental-Software-for-Digital-Smile-Design.pdf
7. Bailey O, McGuirk C, O´Connor C. Matrix transfer techniques for direct paste composite resins. Br Dent J. 2022 Jul 22;233(2):91–8.
8. Ward DH. Proportional Smile Design. Dental Clinics of North America. 2015 Jul;59(3):623–38.
9. Naini FB, Gill DS. Facial Aesthetics: 2. Clinical Assessment. Dent Update. 2008 Apr 2;35(3):159–70.
10. Chitlange PM, Madhu PP, Reche A. Digital Smile Design- An Overview of 3D Digital Workflow. JCDR [Internet]. 2023 [cited 2023 Sep 29]; Available from: https://www.jcdr.net//article_fulltext.asp?issn=0973-709x&year=2023&month=January&volume=17&issue=1&page=ZE01-ZE05&id=17386