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Enhancing Smiles With Technology: Case Reports

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ABSTRACT

In current-day dental practice with increasing patient's esthetic expectations, smile designing has evolved leaps and bounds in the past decade with the advent of new materials and technical improvement as well. Digital Smile Design (DSD) using Computer- Aided Design and Computer-Aided Manufacturing (CAD/CAM) technology is a modern approach in dentistry that combines digital tools to enhance smile esthetics and precision indental treatments. CAD/CAM technology enables dentists to create highly accurate digital models of patient's teeth and surrounding structures. Integrating CAD/CAM technology withdigital smile design streamlines the treatment process, improves accuracy, and enhances patient satisfaction. Patient can preview the proposed treatment outcomes through digital simulations, providing valuable feedback and ensuring that their expectations are met. Overall, digital smile design using CAD/CAM technology represents a cutting-edge approachto cosmetic dentistry, offering precise, customized solutions for smile enhancement. By leveraging advanced digital tools, dentists can create beautiful, natural-looking smiles that enhance both appearance and oral health. This case report aimed to present integrated planning related to functional and esthetic requirements from the patient based on digital design parameters.

Keywords: Smile Designing, Digital Smile Design, Smile Esthetics, ceramic veneers

1. INTRODUCTION

Smile designing addresses various aesthetic and functional concerns related to smile, teeth,and overall facial appearance, providing comprehensive solutions to enhance cosmetic appearance, correction of dental imperfections, functional improvement, restoration of dental health, customized treatment and psychological well-being.

Digital smile designing is a revolutionary approach in dentistry that utilizes advanced computer technology to plan and design a patient's ideal smile before any treatment begins.It involves the use of specialized software to analyse facial features, dental proportions, and esthetics to create a customized smile makeover plan.(1) Through digital smile designing, dentists can communicate effectively with patients, showing them simulated images of how their smile will look after cosmetic dental procedures such as teeth whitening, veneers, or orthodontic treatments. This allows patients to visualize the potential outcomes and actively participate in decision-making.(2)

Moreover, digital smile designing enables precise treatment planning, ensuring that the finalresult meets the patient's expectations and enhances their facial harmony and confidence. By combining artistry with technology, dentists can achieve predictable and stunning smile transformations, improving not only the appearance but also the overall health and well- being of the patients.

2. CASE REPORTS

CASE 1

A 45-year-old female patient reported to the department of conservative dentistry and endodontics, School of Dental Sciences with chief complaint of unesthetic smile and previously done anterior restorations around 4 years back.(fig1) Patient was highly esthetically concerned and had reported for the same. On clinical

examination, it was found multiple faulty anterior composite restorations irt 11 12 13 21 22 23. An explaination of the available treatment options was given to the patient which were orthodontic treatment andceramic veneering. As patient wanted more conservative approach in shorter duration so treatment option opted was ceramic veneering. There are multiple ways for doing ceramic veneering. So, when latest digital technology of CAD/CAM was explained to the patient, patient was convinced to see the pretreatment outcomes of the treatment.

Fig 1: Pre operative

In patient's 1st visit, the shade was selected with VITA 3D master shade guide under natural light and impression was taken and then sent to the lab to predict the outcome of the treatment.(fig2) Digital model fabrication was done with new simulated smile. After getting the results approved by the patient, in 2nd visit of recall, previously done anterior restorations were removed and minimal 1mm tooth preparation was done on labial side and incisal edge and incisal lapping was prepared. After that impression was taken and sent to lab.(fig3) Veneers were then designed using CAD CAM technology. (fig4-9)

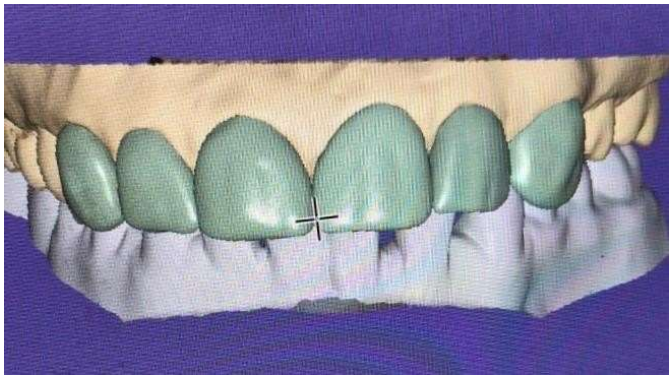

Fig 2: Digital model fabrication with new simulated smile

On 3rd visit, the quality of fit, gingival extension and colour match of the veneer was assessed.All six veneers were tried by placing them one by one to check adaptation and alignment. Anadded precautions were taken while placing veneer on tooth ensuring the proper isolatione.After that veneer's textured surface was treated with 30% hydrofluoric gel, washed, and coated with a silane coupling agent. The tooth was carefully prepared, isolated and treated with 37% orthophosphoric acid, followed by the application of prime & bond NT dentin bonding agent as per the manufacturer's guidelines. Calibra resin luting cement was utilized to affix the veneers, with excess material removed before curing with a visible light device for 40 sec per tooth. Final adjustments were made using rotating abrasive discs, and patient was further given instructions for maintaining oral hygiene.(fig 10)

Fig 3: Impression of prepared teeth

Fig 4: facial view of veneered tooth in software

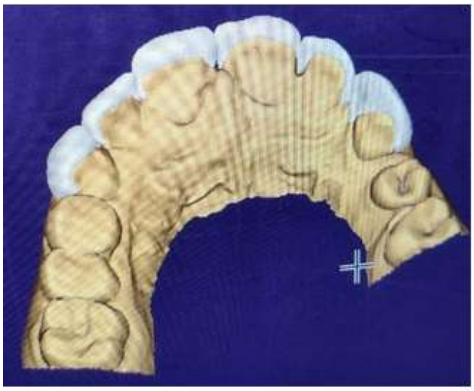

Fig 5: Incisal lapping

Fig 6: Recontouring of canine

Fig 7: canine was tilted mesially

Fig 8: final CAD/CAM results

Fig 9: Final veneers on cast

Fig 10: Post operative

3. CASE 2

A 29-year-old female patient reported to the department of conservative dentistry and endodontics, School of Dental Sciences with chief complaint of discoloration and multiple caries and faulty restorations in anterior teeth which was done 6 years back.(fig 11) A thorough visual assessment was performed to evaluate the occlusion, morphologic, and optical characteristics were analysed. The medical history was not significant. On clinical examination it was found that patient had severe fluorosis. Further examination revealed 11and 21 had previously done discoloured composite restorations, 13 and 23 had carious cervical lesion and class IV caries was present on the palatal aspect of 22 which was involvingthe pulp. After a thorough examination and assessment of the patient's smile, it was determined that ceramic veneers would be most suitable for the condition in 11 12 13 21 23while 22 demanded root canal treatment followed by ceramic crown.

Fig 11: Pre-operative

In the 1st visit, single visit root canal treatment was done irt 22 following proper irrigationprotocol and single cone obturation technique. Cervical lesions irt 13 was restored in 13 with conventional glass ionomer cement. In the 2nd visit, before initiating tooth preparation, the shade of the teeth was determined using a vita shade guide. After that, the process of tooth preparation for ceramic veneer wascommenced which involved 0.5mm depth cutting bur on the outer surface, starting from the gum line and progressing towards the biting edge. The inner margin was positioned slightly above the contact point. Careful shaping was done on the outer surfaces to maintaintheir natural shape. A long, tapered chamfer-ended diamond bur was employed to refine the outer surface, ensuring clear gum and neighbouring tooth edges. The chamfer was extended slightly into the spaces between the teeth to ensure complete coverage by the veneers. Tooth preparation for ceramic crown was done by cutting 0.5mm on all the surfaces and chamfer finish line was given.(fig 12) After completion of the teeth preparationfull arch impressions were taken with an addition silicone impressions material (Aquasil, DENTSPLY SIRONA, USA) and an occlusal registration was made. The impression, along with detailed instructions regarding the desired final shade, length, width, and position of the front teeth, was sent to the laboratory. There, refractory stone model of the prepared teethwas created, and ceramic veneers were crafted. (fig 13-14)

Fig 12: Crown preparation and restoration

In the 3rd visit of recall, before final placement in the patient's mouth, the veneers and ceramic crown were examined at the dental office for proper fit, marginal adaptation, appearance, translucency, shade, and absence of any gaps in the gum area. A trial fitting was conducted, where each veneer was individually assessed for precise marginal alignment. For the final placement, the prepared teeth were then cleaned with pumice and rinsed. Subsequently, the enamel surfaces were treated with 37% phosphoric acid for 15 seconds, followed by thorough rinsing and maintaining a slight moisture level. A one-bottle bonding agent was applied in two coats using an applicator brush and cured with a light- curing unit for 20 seconds. After etching and applying silane to the interior surface of the ceramic veneer and crown, resin cement was used for cementation. The veneers and crownwere gently pressed into position, held in place with a gloved finger, and cured for 20 seconds on the incisal, buccal and palatal aspects (fig 15). A follow-up appointed was scheduled for six months later.

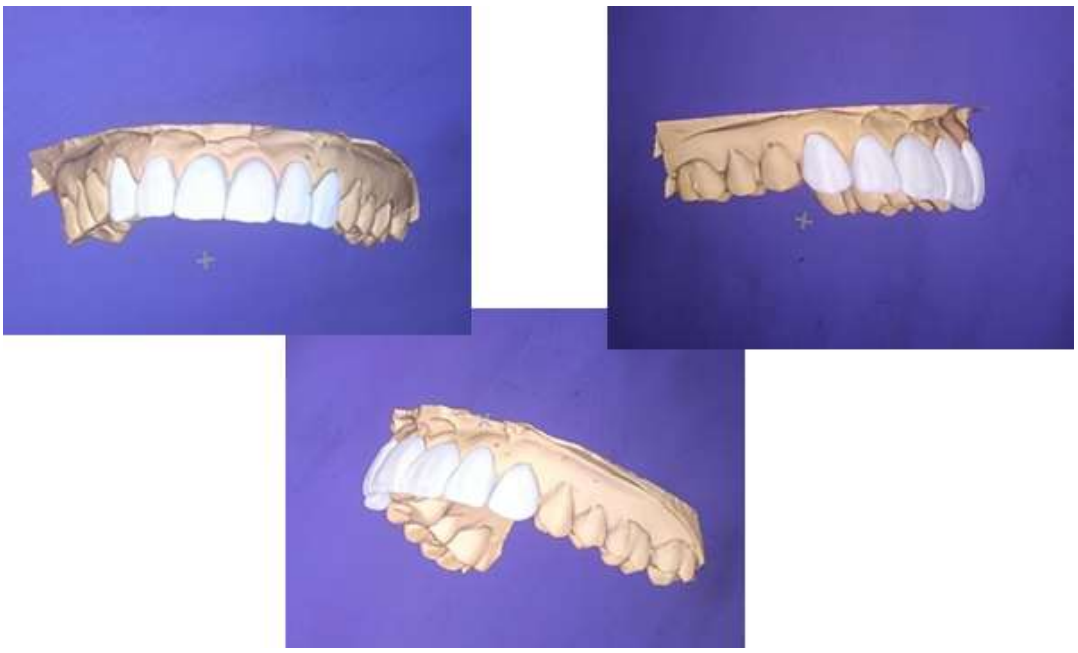

Fig 13: CAD CAM results

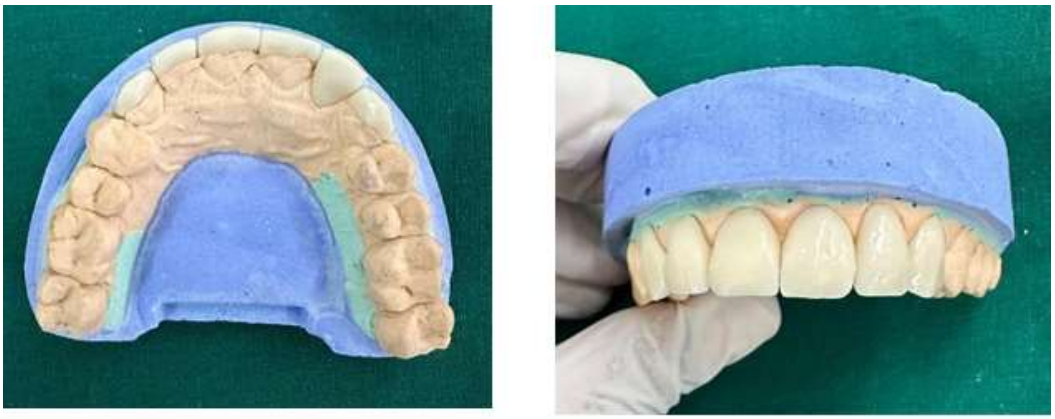

Fig 14: final veneers on cast

Fig 15: Post operative

4. DISCUSSION

Digital smile designing (DSD) software has revolutionized the field of cosmetic dentistry by allowing dentists to plan and visualize dental treatments with high precision and esthetics. There are many software which are popular due to their ability to provide accurate and esthetically pleasing treatment plans, enhancing patient satisfaction and improving the overall quality of dental care.[4] DSD App, tailored for comprehensive smile design, integratesfacial analysis, dental esthetics and digital workflows. 3Shape Smile design utilizes advanced scanning and modelling technologies. It offers tools for digital impressions, orthodontic planning, and prosthetic design. While exocad is a versatile CAD software for designing dentalrestorations, including crowns, bridges, and dentures. It offers a smile creator module specifically for smile designing and allows for the integration of facial scans and digital impressions to create realistic and functional smile designs. Planmeca Romexis Smile Design is a software that offers a user-friendly interface for creating and visualizing smile designs. It integrates with Planmeca's imaging system for comprehensive treatment planning. NemotecDental Studio is another software for a comprehensive platform offering tools for orthodontics, implantology, and smile design. It provides 3D visualization and simulation capabilities. Smile Design Pro focuses on creating quick and effective smile simulations and allows for the importation of patient photos and the creation of detailed treatment plans. It is primarily used for initial consultations to provide patients with a visual representation of potential treatment outcomes. Photoshop with Smile Design Add-ons utilized by dental. professionals for detailed esthetic planning and to communicate potential outcomes to patients. In this adobe photoshop can be enhanced with specific dental design plugins to create realistic smile simulations. Each of these software tools offers unique features that cater to different aspects of digital smile designing.[5]

In this case report Exocad software was used for smile designing due to its versatility and comprehensive range of features. Unlike many other software options that may focus solely on esthetic visualization, Exocad offers an extensive suite of tools for designing a wide array of dental restorations, including crowns, bridges, and dentures. Its robust integration capabilities allow swamless incorporation of facial scans and digital impressions, ensuring highly realistic and functional smile designs.[6] Additionally, Exocad is user friendly

interface and modular approach enable dental professionals to customize their workflows according tospecific needs, making it a highly adaptable and efficient tool for both simple and complex dental procedures.

Veneer restoration stands out as the top choice for enhancing the aesthetic appeal of anterior teeth. Ensuring accurate diagnosis and treatment planning is crucial for determining the mostsuitable approach, whether it involves direct composite resin, indirect composite resin, or indirect ceramic veneers.[7] This careful consideration is essential for ensuring the success and effectiveness of the treatment.

Digital smile designing aids us in designing better smiles, effective treatment plans, increasedperceived value and greater acceptance from patients. This case report using DSD aids in motivating and educating patients even before the start of treatment, so in such cases whereesthetic demands are high and cooperation is needed from patients, this technique can be aboon to day-to-day practice. It helps in visual communication and the involvement of patients in their smile designing.

In the 1st case report, a female patient walked into clinic with the complaint of unesthetic smile where many treatment options offered to patient like direct composite restorations, ceramic crown, orthodontic treatment and ceramic veneering. But due to the long treatmenttime and reversal of orthodontic treatment, gross tooth reduction in crown placement, and short shelf life of direct restoration, ceramic veneering option was chosen by the patient as it involves minimal tooth reduction, treatment time is short and has long life span. In this case the spacing between the teeth was more than 2mm which make the space closure more difficult. the height of the teeth was increased so that they would not look broad and spacing between the lateral incisor and canine was upto 3-4 mm, so canine was tilted mesially in orderto fill the space. Thus, DSD is one such protocol aiding us in providing desired and esthetically pleasing smile.

In the 2nd case report, a female patient walked into clinic with complaint of severe fluorosis, previously filled discolored restorations and carious teeth. On examination, right side lateral incisor was indicated for root canal treatment and for remaining teeth several options were given to patient direct composite veneer, indirect composite veneer and ceramic veneer outof which ceramic veneer were opted by the patient. Before preparing the teeth, all carious teeth were filled with glass ionomer cement and root canal treatment of indicated teeth wascompleted in single visit.

In both the cases preparation was done with incisal lapping. Smales et al., determined the clinical success rate of 110 ceramic veneers for seven years and stated a 96% success rate forincisal overlap design as opposed to the 86% success in veneers.[8] The entire tooth preparation focused solely on the enamel to ensure dependable bonding, thereby enhancingbonding strength and extending the lifespan of the veneers. By avoiding dentin involvement,both intraoperative and postoperative sensitivity risks are significantly minimized.[9]

One of the main advantages of DSD is that patient can preview potential treatment outcomes before any procedures are performed, empowering them to make informed decisions abouttheir dental care. This advanced technique not only improves communication between patients and dental professionals but also enables precise execution of treatment plans, resulting in more predictable and satisfying results. DSD has revolutionized smile makeovers by offering a comprehensive and patient-centered approach to dental aesthetics.[10]

5. CONCLUSION

The DSD is an innovative tool that helps the clinician to create esthetically pleasing smiles.Previsualization drastically increases the patient's acceptance rate. The technology also makes the patient a part of the decision-making process by including their preferences.

Although caution should be exercised that ideal case selection is always necessary to have asuccessful outcome. Patients should be enlightened about the potential ups and downs thatthey might face if the results are not up to their expectations. But there are certain limitations of DSD like affordability and software images do not always match the original image, so patients might disagree with pertaining outcomes. Further innovations are still demanded in more economical ways to make it more affordable to patients.

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