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PROSTHETIC REHABILITATION OF MAXILLARY ANTERIOR TRAUMA CASES USING DIGITAL SMILE DESIGN (DSD) - A CASE REPORT

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ABSTRACT:
"A Captivating Smile Showing an even row of natural gleaming white teeth is a major factor in achieving that elusive dominant characteristic known as Personality – Dr. Charles Pincus". Digital Smile Design (DSD) serves as an essential tool in aesthetic dentistry, enhancing the accuracy and reliability of smile rehabilitation procedures. It increases the precision of treatment planning, allowing for better prediction of outcomes.
This case report aimed to present a maxillary anterior teeth trauma rehabilitate with digital smile design based on measurements digital ruler.
Smile design should consistently be approached as a multifaceted decision-making process, allowing to provide tailored to interdisciplinary approach. The treatment plan of this case included of complete oral prophylaxis and intentional root canal treatment followed by tooth preparation.
Key words: DSD (digital smile design), maxillary anterior trauma, smile aesthetics.

Introduction

A smile is a key facial expression that conveys various emotions and social signals, such as happiness, friendliness, agreement, and appreciation. The increasing demand for aesthetics has paved the way for the development of new techniques Technological tools like the Digital Smile Design (DSD) protocol enhance communication among team members and between professionals and patients, ensuring that everyone involved in the treatment is aligned with the same plan and objective. [(1)] Patients often have concerns about the final outcome of smile design treatments; in these cases, DSD proves invaluable. It helps motivate and educate patients by providing a preview of the final result before treatment begins. By creating and presenting a digital mock-up of the new smile, DSD serves as a technical tool for designing and modifying smiles. This process promotes visual communication and engages patients in their smile design, ensuring a more predictable treatment outcome and greater patient acceptance, which ultimately boosts their confidence. [(2)]

Dental trauma due to road traffic accident is quite common, and the treatment plan is frequently guided by the affected area, missing tooth and occlusion. For such cases a comprehensive interdisciplinary approach might deliver an improved aesthetics and functionality, thereby enhancing patient health. In complex cases like these, Digital Smile Designing proves highly beneficial for simplifying the treatment planning process. [(3)] This case report outlines an interdisciplinary approach using Digital Smile Design to restore both function and aesthetics in the maxillary anteriors lost due to road traffic accident. The accurate and effective application of Digital Smile Design in this case allowed for the creation of an ideal and satisfying smile and increased the predictability of success in smile design.

Case report

A 25-year-old male patient visited to the department of prosthodontics at Adhiparasakthi Dental College and Hospital, Melmaruvathur, with the chief complaint of missing upper front tooth region (fig 1&2). The patient's dental history revealed that the tooth loss resulted from a road traffic accident that occurred six months ago. The patient had no history of systemic diseases or allergies to drugs or food. Informed consent was obtained before proceeding with the treatment. The patient signed the consent form, and all necessary records, including impressions and radiographs were collected. The clinical and radiological examination revealed patient had missing 12,21,22 and Rotated 11(fig3&4). The Right central incisor (11) was rotated distolabially which was the major concern in this case. The treatment plan, developed using

Digital Smile Design (DSD), was presented to the patient. After reviewing the images and understanding the predictability of the final outcome, the patient agreed to proceed with the proposed treatment. Digital Smile Design (DSD) is a detailed imaging and modelling protocol that enhances communication between the dentist and patient, aiding in the development of a personalized treatment plan for cosmetic dentistry procedures.

Figure 1 and 2: extra oral profile and intra oral photos.

The following photographs were taken

1. Frontal view of the face at Rest
2. Frontal view of the face with wide smile
3. Sagittal view of the face at rest
4. Sagittal view of the face with wide smile
5. 12 O' clock view with wide smile and maxillary incisal edge resting on lower lip
6. Intra oral frontal view of both maxillary and mandibular arch in maximum intercuspation

Figure 3 and 4: OPG and IOPA of maxillary anterior.

In the first phase of treatment, scaling was performed, and oral hygiene instructions were provided to enhance the patient's oral hygiene practices and gingival health. This phase aimed to prevent further dental issues and ensure a solid foundation for subsequent treatments.

All photographs captured are uploaded to Exocad software for digital processing and enhancement. The two primary factors to evaluate in DSD are facial aesthetics and gingival aesthetics. In facial aesthetics, horizontal and vertical reference lines are established using an extraoral front photograph (fig 5&6).

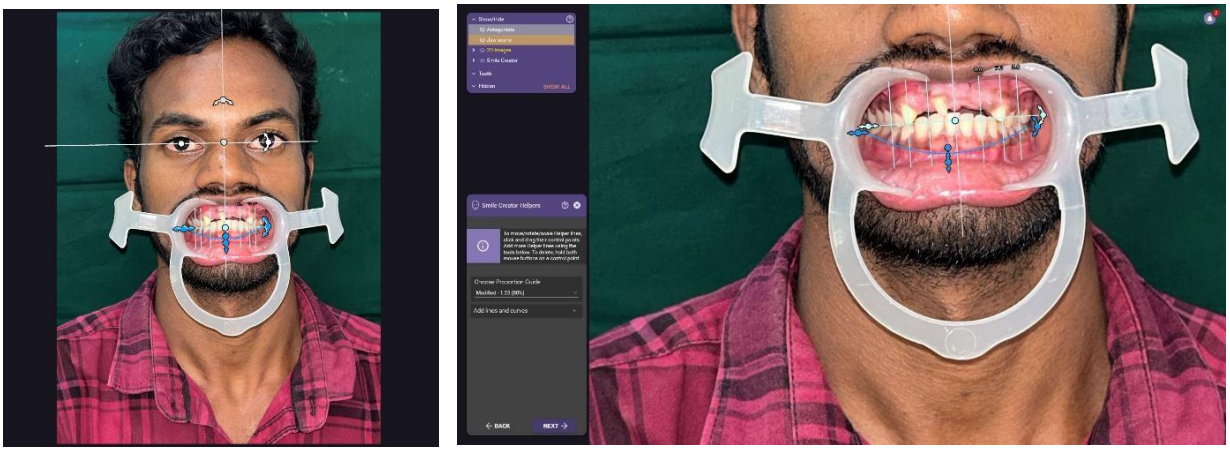

Figure 5 and 6: interpupillary and vertical lines are established in patient extra oral photos by digital smile

The horizontal reference lines include the interpupillary line and the intercommissural line, which should be parallel to the incisal edges of the maxillary anterior teeth. The vertical reference lines encompass the glabella, the nose, the gingival midline, and the mandible. Following the evaluation of facial aesthetics, a gingival analysis was performed. To assess gingival display, in intraoral retracted photograph the length of the upper lip is measured both at rest and during a smile. The smile curve is established by aligning it with the curvature of maxillary anterior teeth. The dental contour is adjusted based on the proportions of the lower lip and the anterior-posterior curvature of the teeth. A facial photograph is then cropped to focus solely on the intraoral view. Three reference lines are marked on the teeth: a horizontal line extending from the tip of one canine to the other and a vertical line through the dental midline, which passes through the interdental papillae. These lines help transfer the cross-reference of the inter-pupillary and facial midline from the face to the intraoral view. Additional lines, such as the gingival zenith and lines

Figure 7 and 8: After tooth preparation in frontal and occlusal view.

connecting the gingival and incisal battlements, are drawn for a comprehensive dental analysis. To determine the ideal teeth dimensions, Golden Proportion theory was applied. Required adjustments are made using a digital ruler, which is calibrated on the photograph by measuring the width of the teeth on the study model. These changes can be refined or adapted based on aesthetic preferences and the individual needs of the patient. Once the design was finalized, it was presented to the patient to review the anticipated treatment outcome. The patient was pleased with the final outcome and consented to move forward with the treatment.

In the second phase of treatment, root canal was performed on right lateral incisor (12) to correct its alignment. The abutment preparation was completed on teeth 13 and 23, and the rotated tooth 11 was corrected through additional preparation to establish a uniform path of insertion (fig 7&8).

On the same day of tooth preparation, temporary restoration was provided using 3D-printed PMMA material (fig 9). An extraoral photograph was taken after the preparation, uploaded into the software, and used to make adjustments to the design for the final prosthesis. The final prosthesis was then manufactured by milling zirconia and cemented using resin cement (fig 10). The patient was recalled for 24 hrs review and one week review.

Figure 9: immediate provisionalization by using PMMA.

Discussion

Digital smile designing is a cutting-edge tool in esthetic dentistry that allows us to forecast the results of treatment, ensuring they meet patients' satisfaction. Designing a smile is more an art form than a specialized technique. Every prosthodontic restoration method requires the integration of various principles from the science of smile design and aesthetic treatment planning. [4] The main aim of digital smile designing is to create a stable masticatory system where the teeth, supporting structures, and joints work together harmoniously to perform their functions effectively.

Figure 10: Final prosthesis.

In this case report, a 27-year-old male presented with a missing front tooth following a road traffic accident and expressed concern about his appearance. Additionally, he had a rotated tooth in the upper right quadrant (11) which could potentially obstruct the placement of a restoration. The patient also indicated a preference against extracting the rotated tooth, as he had already lost three other teeth. In the present case the patient was explained about DSD and he consented to the digital smile designing protocol due to its advantages. [5] The design was executed using Exocad software, with a key benefit being the creation of a 3D-printed model. This model enhanced the patient's confidence in the dentist's work and proved valuable for a test drive prior to the final preparation. [6] The most crucial and initial step in Digital Smile Design (DSD) is capturing an accurate photograph, as it ensures precision in designing the restoration. If the reference photography is not accurate, it can negatively impact the entire treatment process and lead to suboptimal restoration outcomes. Intraoral scanning has largely replaced traditional impression techniques, offering numerous advantages by ensuring that the acquired data is both repeatable and accurate. [7] The management of the scanned file occurs almost immediately, allowing for real-time evaluation and adjustments while the patient remains in the chair. [8] This

process enhances patient comfort by reducing chair time. Additionally, laboratory procedures can be conducted directly within a virtual CAD environment, utilizing the printing of a stereolithographic model with removable dies. In this specific case, provisional restorations were designed using CAD, printed in PMMA, and verified on a stereolithographic nylon model, which is recognized as the most precise material available. [9]

Pre operative and post operative photos are compared (fig11 &12)

Figure 11 and 12: pre and post operative extra oral photos.

Advantages of using DSD [10]

- ✓ Enhanced Visualization and patient engagement
- ✓ Precision and accuracy
- ✓ Customization according to patient
- ✓ Improved treatment planning
- ✓ Predictive testing by giving temporary restoration
- ✓ Time efficiency by reducing laboratory hours

Disadvantages of using DSD [10]

- ✓ Technology Dependence
- ✓ Software limitations and costs
- ✓ Extensive training for the software

Conclusion

As Devan stated "perpetual preservation of what remains is more important than the meticulous replacement of what is missing". A beautiful smile has long been a significant factor in attractiveness, influencing an individual's overall psychology and boosting self-confidence. Digital Smile Design (DSD) software serves not only as an aesthetic template but also enhances predictability for both patients and clinicians throughout the treatment process. By applying DSD precisely and appropriately, we can design a smile that is both optimal and satisfying, thereby increasing the likelihood of a successful outcome.

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