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RESEARCH ARTICLE

TOPIC-DIGITAL SMILE DESIGNING (DSD) PROTOCOL TO REHABILITATE A TRAUMA CASE- A CASE REPORT

Dr. Prafulla Thumati, Dr. Padmaja S, *Dr. Rakhi Manwani and Dr. Minal Mahantshetty

Dayananda Sagar College of Dental Sciences, Bangalore, India

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ABSTRACT

Objective - Appropriate application of principles of smile designing for any restorative work can drastically improve the esthetics of the patients. This case report describes the treatment for fractured maxillary anterior teeth using digital smile designing technique rather the conventional approach. Background - Much Literature is available on conventional smile designing but discussion on digital smile designing is sparse. Clinical Considerations - The treatment plan included digital smile designing and measurements using digital ruler, diagnostic wax up and fabrication of crowns. Conclusion-Digital smile designing is a promising treatment option for good esthetic outcomes.

INTRODUCTION

Colouring is the sunshine of art that clothes poverty in smiles, while it heightens the interest and doubles the charm of beauty. The science of Aesthetics literally means, "The science of beauty in nature and arts". Beauty itself is a combination of reality and personal perception. Esthetics denotes concern about beauty or appreciation of beauty. The perception of esthetics varies from person to person and is influenced by personal experiences and social environments.¹ The aesthetic dentist should have a thorough knowledge and appreciation of the artistic principles that can be applied to the dento-facial complex and should combine artistic creativity with scientific discretion to effect an appreciable change in the dentition. The science of aesthetic dentistry cannot be called a perfect science due to its inherent variations with respect to evolution, geographic locations, social & racial factors. Excessive loss of dental hard tissue poses difficulties for the esthetic rehabilitation, especially complicated crown fracture's due to traumatic dental injury. In such situations an interdisciplinary approach is necessary to resolve the aesthetic & functional problems using a combination of Endodontic, Periodontic and Prosthodontic treatments. The smile we create should be aesthetically appealing and functionally sound and requires a comprehensive approach to patient care. The Digital Smile Design (DSD) is an esthetic treatment designing tool that can strengthen diagnostic vision, improve communication between the interdisciplinary dental team as well as laboratory

technician, and enhance the treatment outcomes. The present case report describes the interdisciplinary Digital Smile Designing approach to restore function and smile designing of Maxillary Anteriors with severe coronal destruction.

Case Report

A Female patient aged 22 years reported to our private practice, Bangalore with a chief complaint of fractured maxillary anterior teeth due to Road Traffic Accident (RTA). The clinical examination revealed Ellis Class III fracture (involvement of enamel, dentin compromising the pulp) of maxillary right central and lateral incisors and left central incisor and scar tissue (fibrosed) on left side of the lip.

Digital Smile Designing Technique

After going through the details of the case, decision was taken to treat the case by Digital Smile Designing (D S D) method that helps analysis of both facial and dental composition of smile. Dental evaluation involves teeth and their relation to gingival tissues. Facial evaluation includes hard and soft tissues of the face (Kokich *et al.*, 1999). There are two facial features which do play a major role in the smile design. These are the interpupillary line and lips. The interpupillary line should be perpendicular to the midline of the face and parallel to the occlusal plane. Lips are important since they create the boundaries of smile design. Any abnormalities in this facial composition should be corrected before correcting the dental composition (Davis, 2007). DSD sketches can be performed in

*Corresponding author: Rakhi Manwani

Dayananda Sagar College of Dental Sciences, Bangalore, India

presentation software such as Keynote or Microsoft PowerPoint. Three basic photographic views are necessary:

- 1) Full face with a wide smile and the teeth apart,
- 2) Full face at rest, and
- 3) Retracted view of the full maxillary arch with teeth apart.

The photographs and videos were downloaded and inserted into the slide presentation. For designing, a series of photographs were taken. In the power point presentation series of windows, a photo was inserted. Two lines must be placed on the center of the slide, forming a cross and the photograph is placed behind these lines. A line was drawn between the pupils and the cant was adjusted by rotating the photograph. The interpupillary line was the first reference line to establish the horizontal reference plane. Then a vertical line was drawn to represent the midline on the face, thus both the horizontal and vertical reference lines forming a cross. The facial photograph with a wide smile and the teeth apart was moved behind the cross to determine the ideal horizontal plane and vertical midline. (Bold white lines in Fig 1)

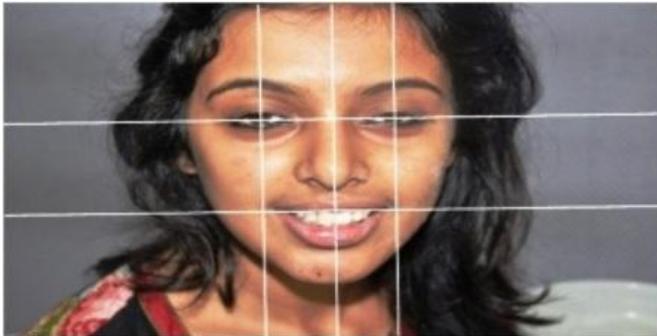


Figure 1. The facial photograph with smile and the teeth apart is moved behind the cross formed by the interpupillary line and the midline of face to determine the ideal horizontal plane and vertical midline

Now this photograph was cropped to show only the intraoral view and three reference lines were marked intraorally for replacement with another intraoral photograph of the patient (Figure 2); a straight line is drawn from canine tip to canine tip (red line), one more line on the incisal edges of central incisors (green line), and another line passing through the dental midline passing through the interdental papillae (black line). This assists in duplicating the cross i.e the reference interpupillary and facial midline on the face onto the intraoral view. Smile arc is determined for the patient i.e the relationship between the the curvature of the incisal edges of the maxillary anterior teeth and the curvature of upper border of the lower lip (Sarver and Ackerman, 2003; Sarver, 2001; Husley, 1970). The ideal relationship desired is parallelism between both (yellow line in figure 2 shows curvature of incisal edges).

Incisal edge position acts as a reference for establishing the tooth proportions. The midline refers to the vertical contact interface between two maxillary centrals. It should be perpendicular to the incisal plane and parallel to the midline of the face. Minor discrepancies between facial and dental midlines are acceptable and, in many instances, not noticeable (Fradeani, 2006). The center of the philtrum is the center of the cupid's bow and it should match the papilla between the

central incisors. Thereafter midline and occlusal plane shifting and canting can be easily detected.

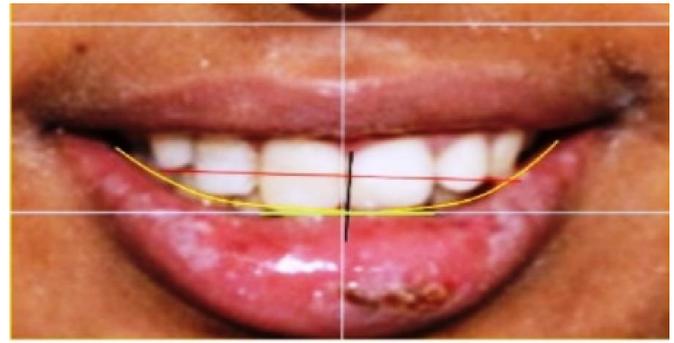


Figure 2. Three reference lines marked on the cropped photograph for replacing it with intraoral photograph

With these lines being the orientation land marks (indexing or tripodding), the current photo was replaced with a new photograph showing the full gum posture. The photo was oriented to the first photo using land marks or lines and then the designing was done. (Figure 3)



Figure 3. Cropped photograph replaced with the intraoral photograph showing complete gum posture, with the help of three reference lines (tripodding)

Now, Rectangles were placed over the incisors to mimic the required length and width of the incisors in accordance with the Golden Proportion grid (1.618:1 i.e the smaller tooth is about 62% of the size of larger tooth) superimposed below the maxillary anterior teeth. Premade tooth size and shapes based on patient's desire as well as it is facial form were also superimposed to see how much difference in width and length is to be achieved. (Figure 4)

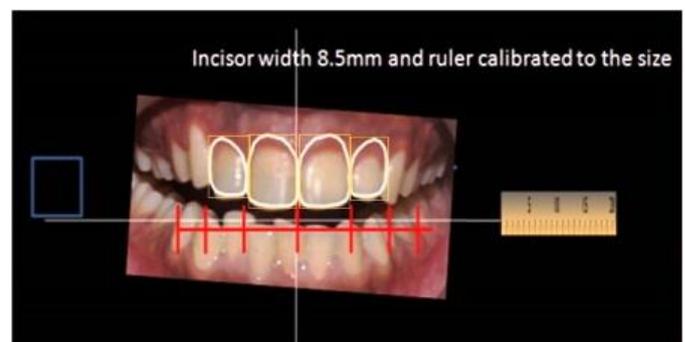


Figure 4. The selection of tooth shape and size superimposed in accordance with the golden proportion grid

Digital ruler can be calibrated on the photograph by measuring the width of the central incisors in the study model. The

proportions of central incisors were compared with the ideal proportions described in dental literature. Here the width of the central incisor was 8.5 mm. This measurement when transferred to the computer helps in the calibration of a digital ruler, photograph of ruler that can be positioned on the slide as necessary. Measurements were made as to how much length and width had to be increased (Figure 5). Thus in accordance with the measurements made at the cervical portion of the incisors and the ideal measurements, the two maxillary central incisors and right side lateral incisor (11,12,21) required 2 mm crown lengthening and the maxillary left lateral incisor required 3 mm crown lengthening for which gingivectomy was performed.

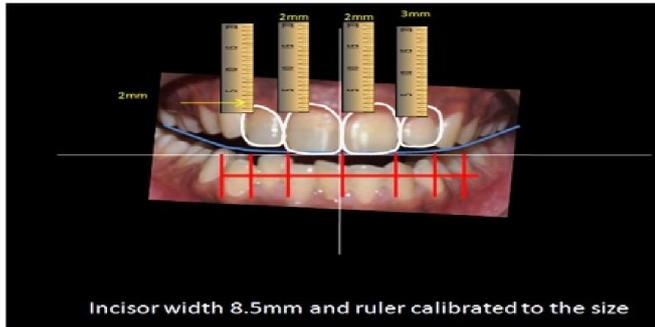


Figure 5. Measurement of the distance between the lines superimposed above the gingival margins with a digital ruler. Calibrated digital ruler on the slide for measurements of difference between preoperative locations of cervical areas with the ideal location

Desired morphology of the tooth was filled with a particular shade selected for the patient (Figure 6). Laboratory was communicated with the soft copy of the photo showing the details of size, morphology and shade for which patient had agreed (Figure 7).



Figure 6. The size & shape of teeth decided is being filled with shade selection colour



Figure 7. Exact size and morphology for communication to the laboratory technician

All the above measurements could also be transferred to the cast for a diagnostic wax up. In this particular case, the new incisal length was measured on the computer and transferred to the provisional restorations with a calliper. Thus crown lengthening and gingivectomies or root coverage procedures could be planned to achieve a good esthetic outcome. In this particular case, Gingival re-contouring was done (gingivectomy) using electro cautery and the soft tissue healing allowed against the temporaries. Once the lab technician developed the mock ups in resin, they were tried in the patient's mouth and then sent back for final work. Then the metal free E-max (lithium di silicate) crowns are bonded using the resin bonded material.

TREATMENT PROCEDURE

1. Irreversible hydrocolloid impressions were made for the diagnostic cast.
2. Diagnostic wax-up was done using white Ivory Wax to evaluate the smile line and to explain the treatment protocol to the patient.
3. After the oral prophylaxis, Root canal treatment was performed for the maxillary central incisors and the right lateral incisor followed by post and composite core build up (crown) using Ivoclar medium Multicore material (Ivoclar Vivadent, Schaan, Liechtenstein).
4. Due to lack of sufficient length of clinical crown, Crown Lengthening was performed on maxillary central incisors and right lateral incisor upto 2 mm & left lateral incisor upto 3 mm, to expose additional tooth structure for better retention and resistance form of the final restoration using Electrocautery (Fig 8).



Figure 8. Electro cautery performed for crown lengthening with respect to the maxillary incisors

5. The patient was recalled after two weeks for review. The teeth were prepared with a 1.5mm ferrule effect for the permanent restoration.(Figure 9)



Figure 9. Crown preparation done with 1.5 mm ferrule and gingival retraction cord placed

6. After tooth preparation, gingival retraction was done, followed by impression with polyvinyl Siloxanes (Ivoclar using type II) using Putty wash impression technique.
7. Scar tissue on the left side of the lip was removed surgically.(Figure 10)



Figure 10. Scar tissue on left side of lower lip removed surgically

8. Provisional restoration fabricated from Silicon Index prepared from the wax-up model using Ivoclar systems C&B II was cemented with Eugenol free zinc oxide cement.(Figure 11)



Figure 11. Digital Smile Designing based provisional restorations luted in place



Figure 12. Post operative metal free E-max crowns cemented in patients mouth and Jewel placed to enhance the esthetics

9. Bite registration was done to record the maxillo-mandibular relationship using vinyl polysiloxane bite registration material. Casts were mounted on a semi-adjustable articulator using a face bow transfer.
10. The Emax crowns (IPS e.max Press, LT, Ivoclar Vivadent crowns were luted with resin reinforced luting agent to the central incisors and right lateral incisor and laminate to left lateral incisor.(Figure 12)

DISCUSSION

According to Pincus, “Aesthetics is the physiologic 4th dimension in oral rehabilitation”. The goal of an esthetic makeover is to develop a peaceful and stable masticatory system, where the teeth, tissues, muscles, skeletal structures and joints all function in harmony (Peter Dawson) (Dawson, 1983). A dental examination is complete if it allows identification of all active factors that are capable of causing deterioration of oral health & function. Both the causes & effects must be analysed to provide better optimal oral health anatomic & functional harmony, comfort & aesthetic. Form & aesthetics go hand in hand. One of the most important goals in aesthetic dentistry is to provide harmonious proportions of the maxillary anterior teeth. The use of a proportional ratio is important when restoring or replacing maxillary anterior teeth (Mahshid *et al.*, 2004).one particular ratio that has been widely discussed in aesthetic dentistry is the Golden Proportion ratio given by Keppler. If one chooses to use this particular ratio, from a facial view tooth proportions are guided by the Golden Proportion (Feigenbaum, 1991). These guidelines state that if the lateral incisor has a width value of 1, then the central incisor width is 1.618 and the canine should be 0.618 (Levin, 1978; Ricketts, 1998; Magne, 2002).

Goldstein affirms the importance of using computerized analyses, enabling the professional to study and discuss the patient’s expectations with the dental professional, since there are no analyses or studies showing what should be applied in clinical practice (Goldstein, 1999). A comparative analysis was also performed by specialists between the results obtained by computerized analyses of the “smile” with subjective analyses of the different levels of factors of the “smile” under study. The McNemar test was used for to compare the results. A study showed significant differences between smile line ($p<0.0001$), golden proportion ($p=0.0170$), labial line ($p=0.0122$) and line between commissures ($p<0.0001$). This study emphasizes the importance of computerized analysis, even for professionals with experience in dental esthetics. The visualization of tracings greatly facilitates analysis when compared with analysis using imaginary lines (Basting *et al.*, 2006). This valuable tool can be used to initiate a dialogue with a patient concerning his or her interest in cosmetic dentistry. The patient can take home a printed copy of his or her smile with the Golden Proportion grid superimposed and share it with family and friends. Digital smile design is a powerful communication tool between technician dentists and the patients. It can improve the acceptance as well as the results of esthetic dental treatment.

Conclusions

The smile that we create should be esthetically appealing and functionally sound. Proper treatment planning is very essential in managing trauma cases. In this particular case traumatised

or fractured teeth have been root canal treated followed by post and cores wherever necessary. Proper computerised smile designing as well as communication with the laboratory technician made the diagnostic wax up easier as well helped in further education of the patients. Crown lengthening procedures were performed wherever necessary using Electrocautery, use of All ceramic laminates and veneers enhanced the overall esthetic outcome. Finally lip surgery was also performed to remove the fibrosed tissue. Thus we have provided a comprehensive esthetic treatment to the patient. This technique of digital smile designing is an extremely useful tool for patient motivation and interdisciplinary as well as laboratory communication. It is a valuable tool for future treatment planning to achieve a desirable esthetic smile.

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