Egyptian Prosthodontic Association (EPA Newsletter)

Digital Smile Design: A Simple Guide To Use The DSD Template

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The Digital Smile Design (DSD) is a multi-use conceptual tool that can strengthen diagnostic vision, improve communication, and enhance predictability throughout treatment. [1] Are the used figures belong to you or taken from references? If not yours, please add the reference.

DSD Workflow Usually, The DSD protocol is carried out using Keynote software (iWork); however, similar software such as Microsoft PowerPoint can be used with minor adjustments to the technique. Three basic photographic views are necessary: full face with a wide smile and the teeth apart, full face at rest, and retracted view of the full maxillary arch with teeth apart. A short video is also recommended in which the patient is prompted by the clinician to explain his or her treatment concerns and expectations. The DSD workflow in the following case was done by Coachman C and Calamita MAthen as follows: [2] 1. The cross: Two lines must be placed on the center of the slide, forming a cross (Fig 1). The facial photograph with the teeth apart should be positioned behind these lines. 2. Digital facebow: Relating the full-face smile image to the horizontal reference line is the most important step in the smile design process. The inter- pupillary line should be the first reference line to establish the horizontal plane, but it should not be the only one. The face as a whole must be analyzed before determining the best horizontal reference to achieve harmony. After determining the horizontal reference line, the facial midline is outlined according to facial features such as the glabella, nose, and chin (Fig 2).

3. Smile analysis: Dragging the horizontal line over the mouth will allow for initial evaluation of the relationship of the facial lines with the smile. Grouping the lines and the facial photographs will allow the clinician to zoom in on the image without loosing the reference between the lines and photograph. Midline and occlusal plane shifting and canting can be easily detected (Fig 3). 4. Smile simulation: Simulations can be performed to fix the incisal edge position, canting, shifting, tooth proportions, and soft tissue outline (Fig 4). 5. Transferring the cross to the intraoral images: To analyze the intraoral photographs in accordance with the facial references, the cross must be transferred to the retracted view using three transferring lines drawn over the smile view as

follows (Fig 5): a) Line 1: from the tip of one canine to the tip of the contralateral canine. b) Line 2: from the middle of the incisal edge of one central incisor to the middle of the incisal edge of the contralateral central incisor. c) Line 3: over the dental midline, from the tip of the midline interdental papillae to the incisal embrasure. It is necessary to calibrate four features on the photograph: size, canting, incisal edge position, and midline position. Line 1 will guide the two first aspects (size and canting), line 2 will guide the incisal edge position, and line 3 will guide the midline position (Fig 6).

6. Measuring tooth proportion: Measuring the width/ length proportion of the central incisors is the first step toward understanding how to best redesign the smile. A rectangle is then placed over the edges of both central incisors (Fig 7). The proportions of the pa - tient!s central incisors can be compared to the ideal proportions described in the literature (Fig 8). [3-4]

7. Tooth outline: From this step on, all drawings may be performed depending on what needs to be visualized for each specific case. For example, tooth outlines can be drawn over the photograph, or tooth outlines can be copied and pasted. The selection of tooth shape will depend on factors such as the morphopsychologic interview and the patient!s desires, facial features, and esthetic expectations (Figs 9 and 10). [5,6] 8. White and pink esthetic evaluation: After all reference lines and drawings have been provided, the clinician should have a clear understanding of the esthetic issues arch, including the tooth proportions, interdental rela - tionship, relationship between the teeth and smile line, discrepancy between facial and dental midlines, midline and occlusal plane canting(Fig 11).

9. Digital ruler calibration: The digital ruler can be calibrated over the intraoral photograph by measuring the length of one of the central incisors on the cast (Fig 12) and transferring this measurement to the computer (Fig 13). Once the digital ruler is calibrat - ed, the clinician can make any measurements needed over the anterior area of the image (Fig 14). 10. Transferring the cross to the cast: First, the horizontal line over the intraoral photograph should be moved above the gingival margin of the six anterior teeth. The distance between the horizontal line and the gingival margin of each tooth is measured us - ing the digital ruler, and these measurements are written down on the slide (Fig 15). The measurements are then transferred to the cast with the aid of a caliper. Pencil marks are made on the cast at the same distances above the gingival margins as shown on the digital images. Those dots are then connected, creating a horizontal line above the teeth. The next step is to transfer the vertical midline. Because the vertical line must be perpendicular to the horizontal line. (Fig 16). Subsequently, the line can be drawn perpendicular to the horizontal line passing over this reference point. After drawing the cross on the cast (Fig 17), all information the technician will need to develop a precise wax-up is available on both the slides and

involved in the patient!s maxillary cast (Fig 18).

The guided diagnostic wax-up will be an important reference for any surgical, orthodontic, and restorative procedures. [7] Several guides can be produced over this wax-up to control the procedures, such as surgical stents, orthodontic guides, implant guides, crown lengthening guides, and tooth preparation guides. [7,8] The next important step to evaluate the precision of the DSD protocol and the wax-up is to perform a clinical try-in (Fig 19). The clinical try-in can be carried out using a direct mock-up or a provisional restoration depending on the complexity of the case. After patient approval, the restorative procedures can be adjusted as necessary. Tooth preparation should be minimally invasive, allowing just enough clearance to create proper space for ceramic restorations (Fig 20). Fabrication of the final restorations should be a controlled process with minimal final adjustments (Fig 21). If all of these steps are carried out properly and carefully, the final result will likely exceed the patient!s expectations (Figs 22 and 23).

Conclusion

The digital smile design is a multi-use tool that can assist the restorative team throughout treatment, improving the dental team!s understanding of the esthetic issues and increasing patient acceptance of the final result. The placement of reference lines and other shapes over extra- and intraoral digital photographs widens the dental team!s diagnostic vision and helps to evaluate the limitations, risk factors, and esthetic principles of a given case. These critical data will lead to improved results in all phases of treatment.

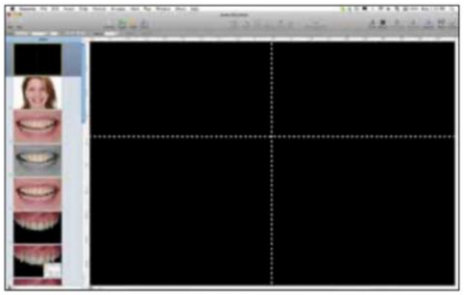

Fig 1 Slide presentation software (Keynote, iWork, Apple) with crossing lines placed on the middle of the slide.

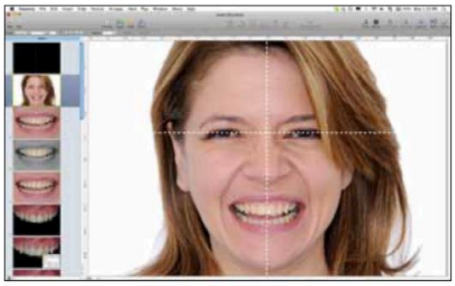

Fig 2 The facial photograph with a wide smile and the teeth apart is moved behind the cross to determine the ideal horizontal plane and vertical midline (ie, the digital facebow).

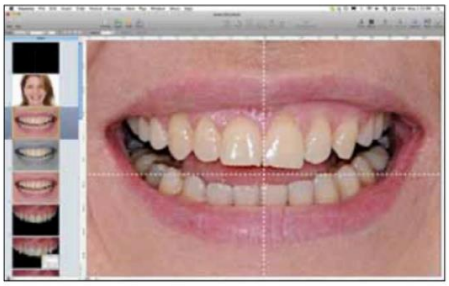

Fig 3 Transferring the cross to the smile: grouping the lines with the facial photograph and zooming in to analyze the relationship between the facial lines, lips, teeth, and gingiva.

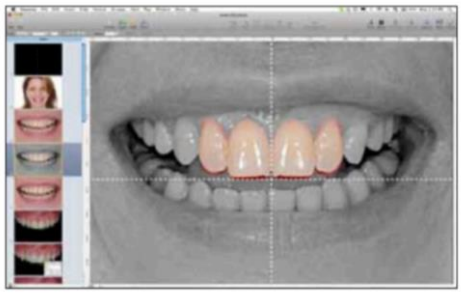

Fig 4 Basic dental simulation performed by cropping the images of the teeth and placing them over the smile photograph, correcting the gingival levels, length, and the canting of the anterior teeth.

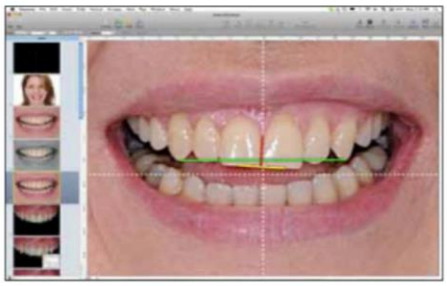

Fig 5 Drawing the three reference lines that will allow for transferring of the cross to the intraoral photograph.

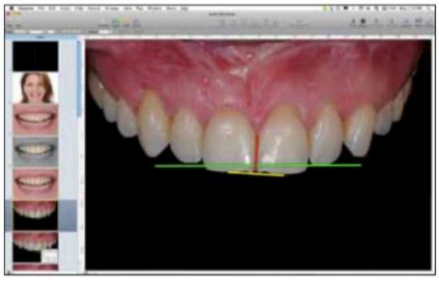

Fig 6 Intraoral photograph adjusted to the three reference lines.

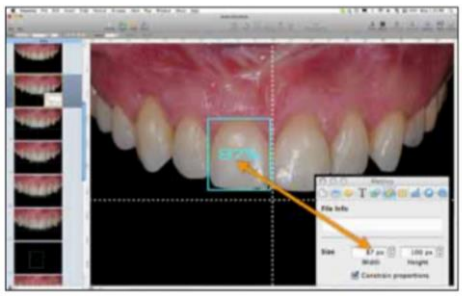

Fig 7 Intraoral photograph with the cross used to measure the actual length/width proportion of the right central incisor.

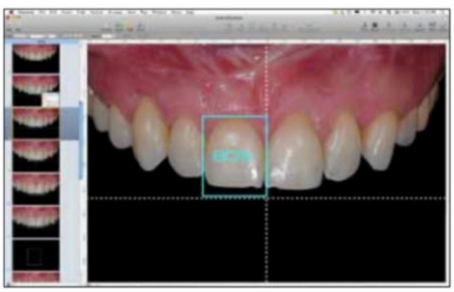

Fig 8 A rectangle with ideal length/width proportion (80%) is placed over the central incisor to compare the actual pretreatment proportion with the ideal one.

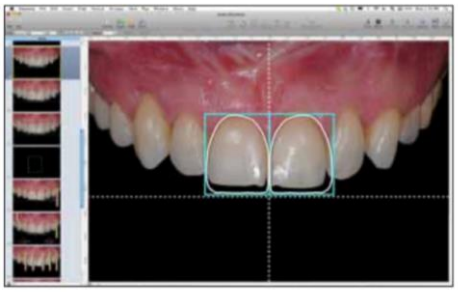

Fig 9 Drawing the tooth outline, as guided by the cross and by the rectangle proportion.

Fig 10 Final teeth outline showing the relationship between the preoperative situation and the ideal design.

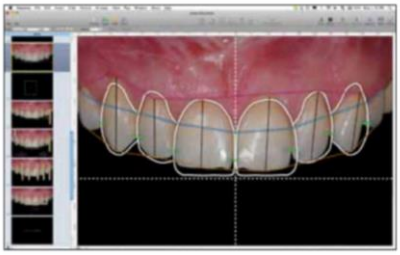

Fig 11 Other drawings and lines can be added as needed to help visualize the esthetic issues and improve the efficiency of communication.

Fig 12 Measuring the length of the left central incisor (10.6 mm) on the cast. This measurement will be transferred to the computer for calibration of the digital ruler.

Fig 13 Calibrating the digital ruler on the slide by shrinking/stretching until it matches the measurement done on the cast. The digital ruler is a photograph of a ruler (JPEG file) that is dragged on top of the slide and can be positioned as necessary.

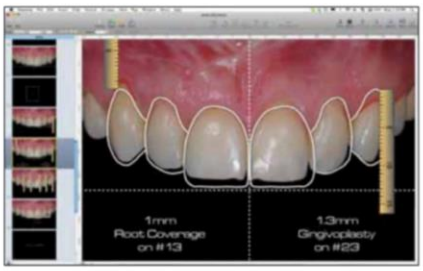

Fig 14 Measurements can be taken of the difference between the preoperative location of the cervical areas of the canines compared to the ideal location. In this case, one maxillary canine needed crown lengthening and the other required root coverage.

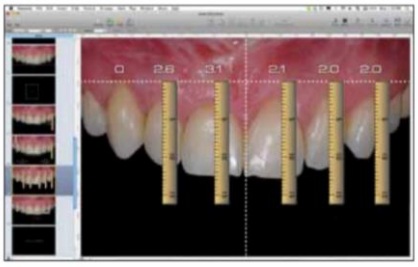

Fig 15 The horizontal line is placed randomly above the gingival margin of the anterior teeth. This distance is then measured and transferred to the stone cast using the digital ruler.

Fig 16 Measuring the discrepancy between the facial midline and dental midline.

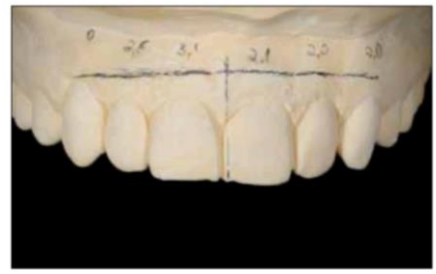

Fig 17 All the measurements are transferred to the cast, and the cross is drawn.

Fig 18 The diagnostic wax-up is fabricated using the cross and morphopsychologic design as guides. The new incisal length is measured on the computer and transferred to the wax-up with a caliper.

Fig 19 Try-in provisional made with bis-acrylic resin is obtained from a silicone index fabricated on top of the diagnostic wax-up.

Fig 20 Final minimally invasive tooth preparation guided by the silicone indexes.

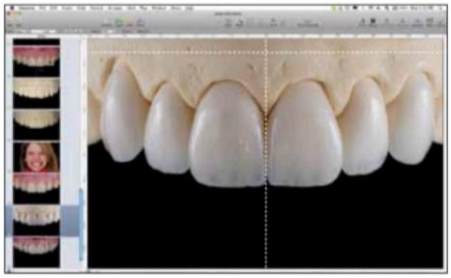

Fig 21 Final ceramic veneers (IPS e.max, Ivoclar Vivadent, Schaan, Liechtenstein) fabricated according to the silicone indexes.

Fig 22 Ceramic veneers after bonding.

Fig 23 Final outcome after 6 months.

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