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EVALUATION OF DIGITAL SMILE DESIGN FOR CLOSURE OF MAXILLARY MEDIAN DIASTEMA WITH PORCELAIN LAMINATE VENEERS (CLINICAL TRIAL)

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ABSTRACT

INTRODUCTION: Among aberrations in smile esthetics is the presence of Maxillary median diastema (MMD). To check the restorative treatment meets the patient's aesthetic request, conventional wax-up is powerfully suggested before the treatment. Digital smile design (DSD) seems to be a useful diagnosis tool for dentogingival alterations. Nowadays, computer aided design and computer aided milling technology (CAD/CAM) requires just few clicks on the computer keyboard to design and produce perfect restorations.
OBJECTIVE: This study aims to Clinical evaluation of using DSD versus conventional wax up technique to close MMD with ceramic veneers.
MATERIAL AND METHODS: Thirty six patients with MMD were allocated for this study. To close MMD, Restorations with ceramic veneers were done using two different smile design techniques. Test group (n=18) used DSD. Control group (n=18) used conventional wax up technique. Patients in all groups returned to the clinic for clinical examination immediate postoperative and at 1, 3, 6, 12 and 18 months according to Esthetic parameters.
RESULTS: It was found that Digital smile design had better correcting effect of different esthetic parameter than conventional smile design. However of non-significant difference between them.
CONCLUSION: DSD appears to be very promising by augmenting the interaction between the patient, the lab and the dentist, which is hard by conventional manual planning. Digital and conventional smile designs protocols are nearly similar.
KEY WORDS: Digital smile design, Conventional wax up, Digital wax up, Ceramic veneers.
RUNNING TITLE : Digital Smile Design evaluation for Diastema closure.

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INTRODUCTION

To practice effective esthetic dentistry, specialists should be able to see the shape and the interrelationship of restorations within the framework of a patient's individual smile. Formulating a treatment plan can clarify any discrepancy identification as well as guide subsequent decisions. To ensure that restorative management meets the patient's esthetic request, diagnostic wax-up is suggested before the absolute treatment. The conventional wax-up includes changing the tooth morphology of the dental model by adding of wax. Recently, Digital Smile Design (DSD) considered being a good diagnosis tool for dentogingival alterations. With few and correct photos digital smile design presents easy steps to evaluate form, size, tooth position and gingival contour (1).
Among the major disharmonies in smile esthetics, is presence of diastema. Maxillary median diastema (MMD) is a familiar esthetic problem. It is well-defined like a space among the proximal sides of the two centrals with more than 0.5 mm. It was found that maxilla has a higher rate of median diastema than mandible (2).

With the enhancements of digital dentistry digital wax-up suggested as a tool for restorative planning. This wax-up form is depending on virtual changes in the dental morphology. Several methods proposed to digitally modify the tooth. This involves the placement of an typical tooth from biogeneric library These features are used to accurately analysis the impact of the dental treatment, such as the aesthetic outcome, material thickness, the potential preparation invasiveness (3).
Therefore, this study aimed to compare between digital smile design and conventional wax ups technique to restore maxillary median diastema using porcelain laminate veneers according to esthetic parameters of dentofacial analysis, occlusal analysis and phonetic analysis. The null hypothesis stands that both conventional wax-up and digital smile design have no significant variance between them.

MATERIAL AND METHODS

Informed consent:
A written informed consent was obtained from all patients who accepted to share in this study after explaining the procedures to them. It was also mentioned that the patient had the right of

withdrawal from the study anytime without any consequences. Ethical approval for this study was obtained before beginning the study from the Research Ethics Committee, Faculty of Dentistry, and Alexandria University, Egypt. All patients received appropriate dental care including removal of local factors, education and motivation to maintain proper oral hygiene

Patient Selection Criteria and randomization:

Thirty six patients conveniently selected for this study. patients with age ranging from 20-50 years sharing in this study was conducted to the illegibility criteria with Inclusion criteria of 2-3 mm median diastema of caries free maxillary central incisors with healthy gingival tissue. Patients of any systemic diseases sever malocclusion, parafunction habits, badly destructed teeth, and those who are unwilling to accept diastema closure as a treatment were excluded. Patients were randomized into two groups with ratio 1:1 .Digital smile Design group (Test group) (n=18) and conventional smile design group (Control group) n=18.

Clinical Procedures:

Prior any treatment Scaling and polishing was done when necessary. Shade selection was done using VITA 3D MASTER shade guide (VITA, Germany). A preliminary impression was made and poured to have study cast (4).

Smile design

A) For the DSD group: To proceed DSD work flow Six photographic views was taken: Full face with a wide smile and the teeth apart, Retracted view of the full maxillary arch with teeth apart, Full face at rest, 12 o'clock view, Retracted right side view and Retracted left side view. Screen shots of video of patient during speaking and occlusion from different sides of view was captured. (10)The photographs and videos was downloaded and inserted into the DSD software (Christian Coachman Software, Microsoft, Washington, USA). DSD workflow was preceded as the following **(figure 1): (4)**

Figure (1): showed Digital smile design A: facial analysis, B: 12 o'clock view analysis, C: right side view analysis , D:left side view analysis , E: Occlusal view analysis, F: Dental analysis of the smile, G:virtual teeth, H: Full face with virtual teeth, I: Dental measurements using digital ruler , J: Dental measurements transfer to the cast using digital calliper, K: Cast with Horizontal, vertical lines and Diagnostic wax up, L: Silicon index on top of DSD based wax up, M: Motivational mock up, N: full face with motivational mock up

Two lines positioned on the midpoint of the slide, creating a cross, the exrtaoral photographs of the face moved behind these lines. To perform digital facebow and facial analysis the image of full-face was positioned regarding the horizontal and vertical guiding lines. The Interpupillary horizontal line was drawn. The Intercomissure horizontal line was parallel to the interpupillary line. The vertical facial midline was outlined passing glabella, nose, and chin. Pupillary commissure vertical line drawn parallel to the facial midline (Figure 1A) (4, 5).

Smile analysis was performed through making the smile line connecting the incisal edge of upper incisors parallel to the lower lip during smile as it helped in detection of length of the teeth and incisal edge position (Figure 1F). Vertical Dental midline detected on the philtrum of the upper lip (4, 5). Transferring all these previous reference lines to the intraoral retracted view was done with help of three transferring reference lines drawn on the smile view Line 1: between the cusp tip point of the right canine to the cusp tip point of the left canine. Line 2: between the middle point of the incisal edge of right central incisor to the middle point of the incisal edge of the left central incisor. Line 3: from the midline tip of the interdental papillae to the level of incisal edge (4).

Dental analysis was preceded on the intraoral retracted view and the analysis corresponding to the golden proportion was done (4). Measuring tooth width to length proportion done by placing a rectangle over the edges of both central incisors (5, 6). Virtual Tooth outline was drawn with axial inclination depending on Morpho psychology – Visagism (7). The virtual tooth was filled with color which is corrected to be matched with the neighboring teeth (Figure 1G) (4). The intraoral and exrtaoral before and after views was shown to the patient to get the acceptance (Figure 1H) (5).

Analysis of the occlusal view (figure 1E) of the upper model to detect tooth malaligment (6). Analysis of the 12 o'clock view (Figure 1B) to see amount of veneer thickness needed to be adjusted following the smile line (6). Analysis of the proximal view (Figure 1C, 1D) to adjust the level of the occlusal plane and incisal edge position with the smile line (6).

Digital ruler calibration was done above the intraoral photo by detecting the length and width of the two centrals on the model using Digital caliper (RS, Pittsburgh, USA) and then adjusting the digital ruler according to the real measurement followed by transferring these measurements to the computer (4).

To Transfer the DSD from the computer to the model a horizontal line on the intraoral photo was inserted over the gingival margin of the six anterior teeth. The distance among the horizontal line and the highest area of the marginal crest of the gingiva of each tooth is determined using the digital ruler (figure1I) (4). Measurements shifted to the cast with the help of a digital caliper (figure 1J). Marks were made with pencil then linked, forming a horizontal line above the teeth on the cast as shown on the digital images (11). Measurements on the model had the same on the photo enabling precise wax-up on cast (Figure 1K) (4).

For better patient communication Try in provisional (motivational mock up) was made with bis-acrylic composite

resin (Protemp™, 3M – ESPE Dental Products, St Paul, MN, USA) produced from a silicone index replica of the DSD based diagnostic wax up (Figure 1L) then finished with diamond burs (Figure 1M). These expectations of veneer restoration on the smile were presented to the patient to take informed consent so the restorative procedure could be started (Figure 1N) (7).

B) For conventional Smile design group it was carried out based on principles of the smile design including midline, tooth size, and gum margins and according to this, one set of study models was used for wax up of the two central incisors (Figure 2A, 2B), Second set was treated by slight veneer preparations in relation to the two central incisors for composite mock up for better communication of the procedure to the patient (Figure 2C, 2D). Smile design was carried out to be explained to the patient to see if it created a solution that pleased the patient. After getting informed consent, the treatment protocols were started. Try-in provisional (Motivational mock up) was made with bis-acrylic composite resin produced from a silicone index replica of the accepted conventional diagnostic wax up then finished with diamond burs (Figure 2E, 2F) (8).

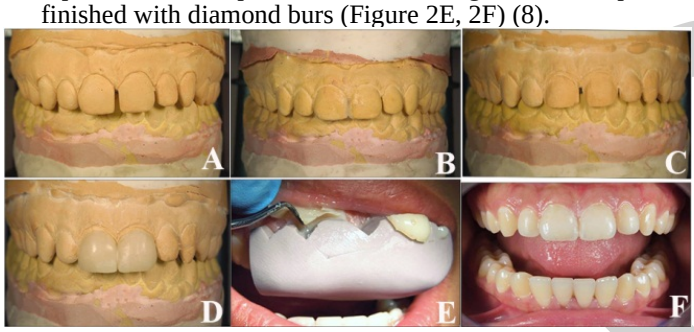

Figure (2): showed Conventional smile design. A: Study cast, B: Study cast with wax up, C: Study cast with slight veneer preparation, D: study cast with composite mock up, E: silicone index, F: Try in provisional (Motivational mock up).

Tooth preparation:

Incisal reduction was done on the incisal edge directed from labial to palatal with depth of 1.5 mm (Figure 3A, 4A) and a palatal chamfer finish line with depth of 1.5 mm (Figure 3B, 4B). Tooth was prepared labially with depth orientation grooves on the labial surface with 0.3 mm depth at the gingival third; 0.5mm depth at the middle third and 0.7 mm depth at the incisal third using calibrated depth cutting diamond bur. Then, vertical tooth reduction among the depth grooves was done (Figure 3C, 4C). The finish line was 0.5mm supragingival chamfer finish line. Distal proximal preparation was done just before breaking Contact area. Mesial proximal preparation was extended palatally to include the entire mesial surface. Preparation was finished by means of tapered diamond finishing bur (Figure 3D, 4D) (9).

Impression making:

After retraction cord placement, a secondary impression was made using a two-step impression technique using vinyl polysiloxane (VPS) heavy and light body impression material for all of the arch including the final preparation followed by pouring in extra hard stone to have the working cast (Figure 3E, 4E) (10).

Provisionalization:

The provisional restoration was made with the Silicon index which loaded with the bis-acrylic composite resin material. The provisional restoration finished with diamond burs (10).

Laminates fabrication techniques

A) For DSD group, the previously done 2D DSD images were sent to the Exocad (CAD CAM software, Germany).Then 3D scanner was positioned over the working cast (Figure 3F). The acquired optical 3D stereolithographic (STL) file image of the model was transferred into the Exocad to have digital model and it was merged with the previously designed 2D Digital smile design images to obtain a virtual image of teeth and smile design (Figure 3G). The preparation finish line was traced and Digital wax up was done regarding adding, contouring and smoothing and virtual articulation. With milling machine, Final design was milled in wax (Figure 3H) (10).

B) For the conventional smile design group, on the poured cast, finish line was traced. Correction of the tooth contours and morphology was done by additive waxing technique. To check occlusion, mounting was done on semi-adjustable articulator (Whip mix, Louisville, USA) (Figure 4F, 4G) (11).

For both groups, the waxes up veneer were fixed and sprued and invested. Lithium disilicate glass ceramic ingot (E-max press, Ivoclar Vivadent, Germany) was fired and pressed according to the manufacturer instruction (12).

Try in and Cementation

Try in of the porcelain veneers was done on the working cast to ensure fitting and contact of the veneers and inside the patient mouth using try in past to ensure the accuracy of the shade matching with the resin cement that would be used also to check again the veneers margins, occlusion and proximal contact.

Cementation procedure included surface treatment of the laminate veneers using 10 % hydrofluoric acid etching gel for 20 seconds, washed, dried, and finally coated with a Silane Coupling agent and left to dry followed by Surface treatment of the tooth under rubber dam isolation by means of using total etch technique through application of 37% phosphoric acid etching gel (Scotchbond™ Universal Etchant, 3M – ESPE Dental Products, St Paul, MN, USA) for 30 seconds then washing, drying followed by coating with a thin layer of adhesive (Adper Single Bond Universal Adhesive, 3M – ESPE Dental Products, St Paul, MN, USA) then light curing for 20 seconds. Ceramic veneers were loaded with luting light cure resin cement (RelyX™ Veneer resin cement, 3M – ESPE Dental Products, St Paul, MN, USA) and placed on the teeth surfaces with light pressure and initial light curing was applied for 5 seconds "tack curing" to create a semigel state for easier excess removal followed by light curing for 40 seconds (Figure 3I, 4H). Occlusion was checked then polished with rubber cups (Figure 3J, 4J).Then patients from both groups were evaluated before and after treatment (figure 5) (13).

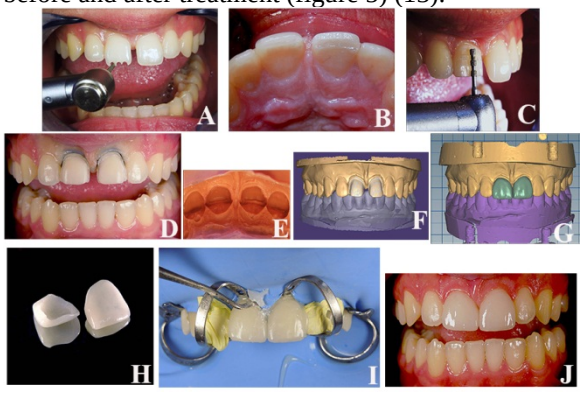

Figure (3): showed procedures of veneers restoration in Digital smile design group. A: Incisal preparation of the veneer, B:

palatal preparation, C: labial preparation, D: Veneer preparation with retraction cord palcement, E:Impression making , F:Digital model, G:Virtual tooth on CADCAM, H:Milled wax veneers, I: cementation of the veneers, J: Veneers After cementation.

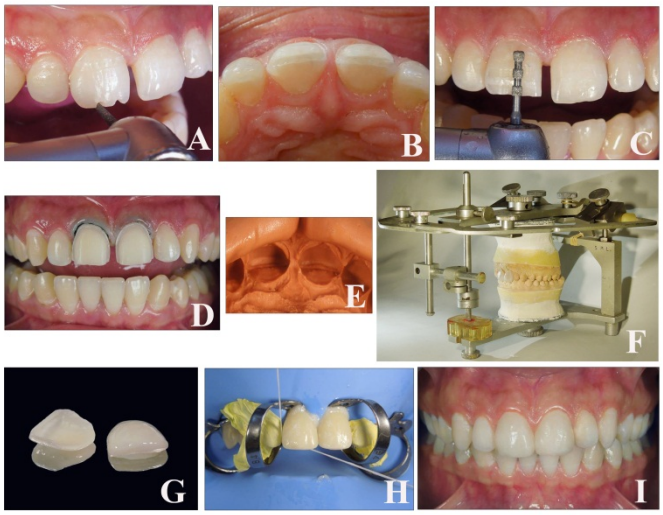

Figure (4): showed procedure of veneer restoration in conventional smile design group. A: Incisal preparation, B: Palatal preparation, C: Labial preparation, D: Final veneer preparation, E: Impression making, F: Conventional wax up on semiadjustable articulator, G: veneer wax build up, H: Veneer cementation, I: final veneer after cementation.

Figure (5): showed before and after treatment of both smile designs. A: before treatment with digital smile design, B: After treatment with digital smile design, C: before treatment with digital smile design, D: After treatment with digital smile design.

Follow up

To ensure the excellence of the restorations each patient was clinically examined before and after treatment immediate post-operative and at 1, 3, 6, 12, 18 months according to the following Esthetic parameters which was registered at Cochrane medical research council for clinical trial (ID: PACTR201901895954408) (table 1) and the scores of each case at different times of follow up was recorded and statistically analyzed (14-18).

Table (1): Esthetic parameters form before and after treatment

Esthetic parameters form		
Point of analysis	**Before treatment**	**After treatment**
I- Dentofacial analysis:		
1-Parallelty of incisal plan with Interpupillary line:	A) Coincident(normal) B) Slanted down to the Right. C) Slanted down to the Left.	A) Coincident(normal) B) Slanted down to the Right. C) Slanted down to the Left.
2-Tooth exposure at rest	A) Low (0-3mm) B) Moderate (normal)(4-6mm) C) High (> 6mm)	A) Low (0-3mm) B) Moderate (normal) (4-6mm) C) High (> 6mm)
3-Incisal curve versus lower lip	A) Convex(normal) B) flat C) Reverse	A) Convex(normal) B) flat C) Reverse
4- Smile line (amount of gingival exposure)	A) Low Smile (<75% Of Clinical Crown Height Of Maxillary Central Incisor) B) Average (normal) Smile (75-100% Of Clinical Crown Height Of Maxillary Central Incisor) C) High Smile .(100% Of Clinical Crown Height And A Band Of Contiguous Gingiva)	A) Low Smile (<75% Of Clinical Crown Height Of Maxillary Central Incisor) B) Average (normal)Smile (75-100% Of Clinical Crown Height Of Maxillary Central Incisor) C) High Smile .(100% Of Clinical Crown Height And A Band Of Contiguous Gingiva)
II- Occlusal analysis:		
1-Overbite (Vertical overlap between Upper and lower incisors)	A) Normal (0-30%) B) Moderate (30-70%) C) Sever (70-100%)	A) Normal (0-30%) B) Moderate (30-70%) C) Sever (70-100%)
2-Over jet (Horizontal overlap between Upper and lower incisors)	A) Normal (1-2mm) B) Moderate (3-5mm) C) sever (more than 5mm)	A) Normal (1-2mm) B) Moderate (3-5mm) C) sever (more than 5mm)
3-Dental Midline with facial midline	A) Coincident(normal) B) Deviated to the Right. C) Deviated to the Left.	A) Coincident(normal) B) Deviated to the Right. C) Deviated to the Left.
III- Phonetic analysis:		
1- M sound: Space between upper & lower lips the rest position	A) Normal (2-4) mm B) less than 2 mm C) more than 4 mm	A) Normal (2-4) mm B) less than 2 mm C) more than 4 mm
2-E sound: The maxillary incisal edge position should be positioned halfway between the upper and lower lip during the "E" sound.	A) At half (normal). B) Above half. C) Below half.	A) At half (normal). B) Above half. C) Below half.
3-S sound: overjet, over bite at rest	A) Normal B) Whistling c) Lisping	A) Normal B) Whistling c) Lisping
4-F/V sound: Maxillary	A) At the vermillion (normal)	A) At the vermillion

incisors in relation to lower lip (vermilion border)	B) Buccal C) Lingual	(normal) B) Buccal C) Lingual

RESULTS

Statistical methodology: Data were gathered and applied to the computer using program of SPSS (Statistical Package for Social Science) for statistical analysis (version 21). To test relations between qualitative variables, Chi-square test was used. (19)

For Dentofacial analysis : For the parameters of Parallelism of incisal plan with interpupillary line, Tooth exposure at rest and Incisal curve versus lower lip it was found that there were no differences between conventional and digital smile design among the follow up intervals. For the parameter of Smile line it was found that Digital smile design had better correcting effect in this esthetic parameter than conventional smile design at immediate post-operative interval with no differences at the other intervals. However; there was no difference significantly between them among the intervals of this study.

For Occlusal analysis: For the parameters of Overbite, Overjet and Dental midline with facial midline it was found that Digital smile design had better correcting effect in this esthetic parameter than conventional smile design at immediate post-operative interval with no differences at the other intervals. However; there was no difference significantly between them among the intervals of this study.

For Phonetic analysis: For the parameters of M sound, E sound, S sound and F/V sound it was found that Digital smile design had better correcting effect in this esthetic parameter than conventional smile design at immediate post-operative interval with no differences at the other intervals. However; there was no significant difference between them among the intervals of this study (Table2) (figure 6).

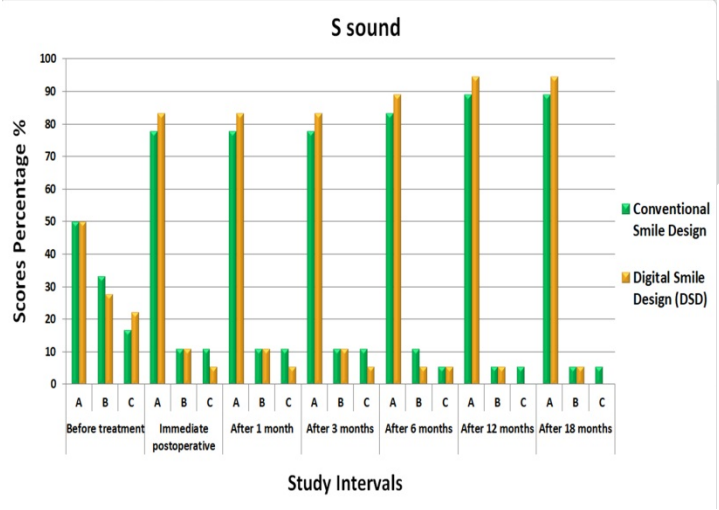

Figure (6): Clustered bar chart of S sound in the two studied groups

Table (2): showed S sound analysis of the two studied groups within intervals of 18 months.

S sound	Study Groups (n=36)				χ^2	p
	Conventional smile design group		Digital smile design group			
	n=18	%100	n=18	100%		
Before treatment						
A	6	50	6	50	0.0	1.000
B	7	38.89	7	38.89		
C	5	16.67	5	27.78		
Immediate post-operative						
A	14	77.78	15	83.33	0.572	^{MC}p=1.000
B	2	11.11	2	11.11		
C	2	11.11	1	5.56		
After 1 month						
A	14	77.78	15	83.11	0.572	^{MC}p=1.000
B	2	11.11	2	11.11		
C	2	11.11	1	5.56		
After 3 months						
A	14	77.78	15	83.33	0.572	^{MC}p=1.000
B	2	11.11	2	11.11		
C	2	11.11	1	5.56		
After 6 months						
A	15	83.33	16	88.89	0.687	^{MC}p=1.000
B	2	11.11	1	5.56		
C	1	5.56	1	5.56		
After 12 months						
A	16	88.89	17	94.44	1.207	^{MC}p=1.000
B	1	5.56	1	5.56		
C	1	5.56	0	0		
After 18 months						
A	16	88.89	17	94.44	1.207	^{MC}p=1.000
B	1	5.56	1	5.56		
C	1	5.56	0	0		
S sound	Study Groups (n=36)				χ^2	p
	Conventional smile design group		Digital smile design group			
	n=18	%100	n=18	100%		
Before treatment						
A	6	50	6	50	0.0	1.000
B	7	38.89	7	38.89		
C	5	16.67	5	27.78		
Immediate post-operative						
A	14	77.78	15	83.33	0.572	^{MC}p=1.000
B	2	11.11	2	11.11		
C	2	11.11	1	5.56		
After 1 month						
A	14	77.78	15	83.11	0.572	^{MC}p=1.000
B	2	11.11	2	11.11		
C	2	11.11	1	5.56		
After 3 months						
A	14	77.78	15	83.33	0.572	^{MC}p=1.000
B	2	11.11	2	11.11		
C	2	11.11	1	5.56		
After 6 months						
A	15	83.33	16	88.89	0.687	^{MC}p=1.000
B	2	11.11	1	5.56		
C	1	5.56	1	5.56		
After 12 months						

A	16	88.89	17	94.44	1.207	MC p=1.000
B	1	5.56	1	5.56		
C	1	5.56	0	0		
After 18 months						
A	16	88.89	17	94.44	1.207	MC p=1.000
B	1	5.56	1	5.56		
C	1	5.56	0	0		

DISCUSSION

Esthetics is adversely affected by diastema with etiological factors attributed to congenital due to supernumerary teeth, missing teeth, jaw size discrepancy, and high frenum level; or acquired due to habits, periodontal disease and tooth loss. The esthetic closure of diastema can be attained by porcelain laminate veneers which become alternative to composite restorations and full crowns as the smiles could be altered painlessly and conservatively (2).

Using conventional diagnostic wax up had benefits in the planning of restorative procedures. Nowadays with DSD photos and videos sent to the lab so they have a better conception about optimization of the facial esthetics results. DSD is a multiuse approach that can help the restorative team through the treatment, better understanding of the esthetic matters and increasing acceptance of the patient to the final result. The positioning of references lines and additional shapes over extra and intraoral digital images extends the dental team's diagnostic concept and helps to estimate the risk factors, limitations, and esthetic ideology of a given case (4).

Besides, motivational mockup was considered as a commonly powerful tool used to assisting the digital treatment planning, as it gives the patient and dentist a 3D vision of the ending outcome of the shape regarding the face, lips, gingiva, and phonetics. While in the diagnostic wax up, patient could see only the shape for the teeth. The Dentofacial analysis is an important element formatting the fine details of the restorations that delivered the eventual esthetics of the case. Recognizing the horizontal and vertical elements of the patient as a normal or in a need to be improved guides the smile makers to how the case should proceed (20).

It was found that Digital smile design had better correcting effect in different esthetic parameters than conventional smile design. However; there was no different significantly between them among the intervals of this study. Digital smile design appears to show some advantages over conventional smile design in relation to smile analysis. However, the definite difference is minimal, which might not be obvious clinically. But, this inspection reflects the advantage of using digital tools in modifying tooth morphologies. For example, the mathematical calculation of tooth contour ensured a reliable and symmetrical result as it depended on library of perfect teeth and it was found to have more defined esthetic features. On the contrary, conventional smile design needed a high artistic ability which was more prone to human error (11).

For Dentofacial analysis, the results showed that DSD is better than conventional smile design but there is no significant difference between them. These guidelines are very important as in a study by Coachman and Calamita (2015) who predicted the final appearance of the restoration, and used to adjust the parallelism of the incisal edge plan to the interpupillary facial line on the DSD software (14).

Including lip form into the design was useful in defining the most accurate incisal edge position following the lip line which affects the tooth exposure which cannot be achieved in the conventional smile design. Introducing the patient image on the software facilitate adjusting the incisal edge positions of templates of the tooth to follow the convexity of the smile line which cannot be achieved in the conventional smile design. Amount of gingival height exposure affected by tooth height and gingival extension. Better results of DSD is due to proper adjusting and detecting of the gingival zenith height and gingival contour on the images on DSD software rather than it in conventional smile design (17).

Occlusal analysis showed that there is no difference significantly between digital and conventional smile design. This may be due to that the selected patient has no or mild malocclusion or habits of bruxism or clenching also the study include only two centrals that have little effect on the occlusion. In addition to that the diastema was closed by veneers with no tension on teeth that decrease the chance to occlusal change or relapse (21).

Phonetic analysis was better in digital smile design than conventional smile design with no significant difference. For M & E sounds, The M sound allowed a vision of the tooth at the rest position. The extended pronunciation of the E sound appearing at the widest smile and explained by a space between upper and lower lips filled by the maxillary incisors. DSD software helped to determine appropriate length and position of the tooth regarding the face and lips. For S, F, and V sounds, The S sound is created by air passing between surface of the tongue and lingual surface of the anterior teeth. Correct phonation of the V and F sounds was achieved during contact of the lower lip (vermilion border) with the incisal edges of the maxillary anterior teeth. DSD software helps in positioning of the incisal edges over the borderline between the dry and wet edge of the lower lip (14).

Several studies illustrated the benefits of using Digital smile design; Zanardi PR et al. (2016) concluded that the DSD concept seems to be a helpful tool to have a satisfactory aesthetic result (22). A two year follow up study by Meereis CT et al. (2016) it was found that DSD can be used to increase communication between specialist and patient also to get better expectations for the rehabilitation of the esthetic smile (10). Coachman C et al. (2016) demonstrated that The DSD workflow making the team to improve the esthetic decision during treatment planning. This process improved the communication between dentists, specialists and patient (23). Coachman C et al. (2017) found that a well-defined procedure using photos and videos improved the examination, smile design decisions, communication and integration between the patient and the specialists to predict the best quality of the treatments (24). Veneziani M et al. (2017) found that intra and exrtaoral esthetic investigations of the patient, with photographs by means of DSD allowed highly esthetic treatment with minimally invasive approach and integration with adequate function (25).

For a two year follow up of diastema closure study by Pinzan-Vercelino CRM et al. (2017) it was found that the use of the DSD could help the clinician in determining dentogingival

alterations with maximum predictability allowing adequate restorative procedures (26). Coachman C.et al. (2018) demonstrated that The Digital Smile Design (DSD) has advantages over conventional smile design as illustrating reference lines and forms over the patient's photo following a programmed progression; let's better estimation of the esthetic link between the face, smile, gingiva and the tooth (27). Şen N et al. (2019) found that functional and esthetic result of a MMD can be gotten with good results with assist of DSD (28).

Also a Systematic review by Cervino G et al. (2019) demonstrated that digitization increased curiosity to dentistry by preparing a speed treatment plan and accurate results (29). Besides, Bassett J et al. (2020) illustrated that the symmetry, harmony, diagnosis, planning, and clinical execution is imperceptible using DSD (30). Also, Jafri Z et al. (2020) illustrated that DSD is a diagnostic tool used to plan, digitally alter the smile of patients and assist them to see it before and after treatment by creating a digital mockup for their new smile (5).

CONCLUSION

Digital and conventional smile design protocols are nearly similar. DSD concept is a assisting tool in picturing of aesthetic problem with better integration between the clinician and the lab technician. It helps patients to imagine their treatment outcome and enhance specialist's diagnosis and treatment planning with understanding the facial features and lip in relation to the teeth according to the Dentofacial, occlusal, phonetic parameters which is hardly achieved by manual conventional planning that depending on artistic dental technician.

DISCLOSURE OF INTEREST

The authors declare that they have no conflict of interest

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