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ORIGINAL ARTICLE

Influential Effect of Digital Smile Design on Orthodontic Treatment Decision

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ABSTRACT

Objective: Since the psychological aspect is necessary for patients' motivation for orthodontic treatment, this study aims to investigate the role of expectations or patient satisfaction on orthodontic treatment via using the Digital Smile Design (DSD) during the treatment planning.

Methods: It is a cross-sectional experimental design involving 52 participants who are unsatisfied with their smiles and not certain about having orthodontic treatment; the participants have been identified and consented to participate in this study after receiving detailed information verbally. A mobile phone camera with a height-adjustable tripod and HP EliteBook 840 G1 portable computer has been used for photograph capturing in this study. After taking the participant's photos and its export to the computer, a PowerPoint template for DSD was used to analyze the photo. Later on, present the pre and post-photo for the participant to evaluate the influence of the expected outcomes on his satisfaction for orthodontic treatment by giving a percentage.

Results: In both Genders, Class I showed the highest percentage among other classes, in addition, crowding represents about three quarter of the cases compared to spacing, concerning their satisfaction it is found that Participants with Class I and II incisors are more satisfied than Class III Participant, while the crowding were more satisfied with DSD results compared to those with spacing.

Conclusion: The DSD is a useful tool in the planning stage of orthodontic treatment and can be used as a visual aid to enhance patient's expectations.

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INTRODUCTION

Orthodontics is one of dental branches concerned with diagnosing and treating any irregularities in teeth position, jaws, and face, in addition to its function and appearance.[1] Orthodontic treatment mainly involves young adults who require higher compliance for the long treatment than other types of dental treatments, and the patient (and/or parents) is often concerned about making decisions. Now a day, current

researches have been interested in investigating the effect of psychosocial factors in treatment outcomes. As often notified, "What patients think will happen can influence what does happen over the clinical course". Expectation is an important psychological factor that estimates the patient's satisfaction with the quality of treatment. Usually, individuals with malocclusions may feel shy about their dental appearance and may affect their social life; for that reason, the orthodontic treatment improves personal confidence concerning their dental and facial appearance[2]. Sometimes, a multidisciplinary approach may be required to attain esthetic and functional results during orthodontic treatment. Using a specific protocol that can be applied to all dentistry specialties seems to be appropriate to communicate, and to expect, consistent outcomes[3]. Digital Smile Design developed by Dr. Christian Coachman (Oral Laboratory Esthetics, Didier and Hélène Crescenzo) are an essential multipurpose digital tool (generally led by the practitioner in charge of esthetic rehabilitation) that provides a reliable protocol with straightforward instructions based on patient's photographs and is achieved by digital processing on slide presentation software. It adopted relevant features: it supports diagnostic abilities, arranges treatment planning, improve patients' education and motivation, and promote the efficiency of case presentation[4,5].

The smile designing includes the following essential components:[6]

- Tooth components include: tooth dimensions, dental midline, contact area, incisal lengths, zenith points, axial inclinations, embrasure area, sex, age and personality.
- Soft tissue components include: smile line, gingival health, harmony and level of gingival.

Because of the importance of the psychological aspects, it is necessary to further consider patients' motivation for orthodontic treatment . This study will implement a new aspect of applying computer-assisted software. This would be via using the Digital Smile Design during the treatment planning stage to provide a future expectation for the possible treatment result and this in turn may help patients in their decision regarding commencing treatment and make their expectations more realistic, which is the objective of this study.

MATERIAL AND METHODS

The research was a cross-sectional experimental study; the Institutional Review Board approved it of the Department of Orthodontics at the College of Dentistry. The sample consists of 52 students has been participated after receiving a detailed consent form. The participants in the study were indicated for fixed appliances, not satisfied with their smiles and not certain about orthodontic treatment. While the study excluded individuals with skeletal discrepancy or indicated for orthognathic surgery, had discolored teeth and had orthodontic treatment.

Mobile phone camera (Galaxy note8 model number (SM-N950F/DS) with 2 cameras has been used. The main one has a 12MP sensor behind a wide-angle, f/1.7 lens. The second is 12MP sensor behind a zoomed lens that provides 2x optical zoom behind a f/2.4 aperture. In addition, a height-adjustable tripod was used to fix the phone. The analyzing equipment consists of HP EliteBook 840 G1 portable computer and DSD PowerPoint template (2013).

The standardization of Mobile Camera and Photographical Technique consisted of adjusting the tripod to support the phone. The tripod controls the stability and the correct height of the phone camera according to the subject's body height; so that the adaptation of the tripod height assists the optical axis of the lens to be maintained in a horizontal position during recording; this was adjusted to each subject's body height. The camera was levelled with the eyes, meaning it would be slightly above the mouth, creating a natural smile curve. Patients instructed nor to lift their chin when smiling. The photos were taken with a distance of one meter and zoom in digitally. The camera was used in its auto mode with f/1.7 aperture. Each participant was asked to be relaxed in a sitting position, with both arms hanging freely beside the trunk. A gloves box was placed behind the patient's head to keep it stable and the background panel in behind.

After taking the participant's photos and selecting the most appropriate one regarding dimensions, clarity, colors, and light, the pictures were exported to the computer. Then, a PowerPoint template for DSD was used. Following photos manipulation with the DSD, the "Before" and "After" photo designs simulating treatment results were placed together in one frame.

The method used for software analysis in this study was based on the method described by Coachman and Calamita (2012),[8] however a simpler and less time-consuming modification was carried out as illustrated in sequence in figures 1 to 12.

The next step following the analysis was to show the participants their photos (Before and after) and ask them how they would evaluate the influence of the expected outcomes. This evaluation was completed by giving a percentage representing their own opinion regarding the impact of the results.

Then, the data, including gender, type of malocclusion, and the evaluation percentage, was imported in an Excel sheet before analysis. Data were collected by an Excel sheet prepared for this purpose including; participant's gender, chief complaint, type of malocclusion, and the degree of satisfaction in percentage. Descriptive statistics, including numbers and percentages were used in this study.

RESULTS

The total number of the participants was 52 with an age range between 19-40 years. Gender was equally distributed (Table 1). Class I showed the highest percentage in both genders, followed by Class II and Class III, respectively (Table 1). In total, crowding represents about three quarter of the cases compared to spacing. Both genders also found a higher crowding percentage (Table 2). Males were slightly

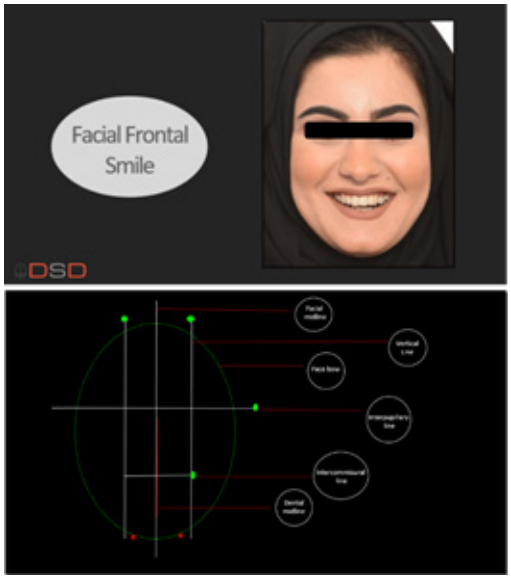

Figure 1: DSD – Tooth Proportion Guides

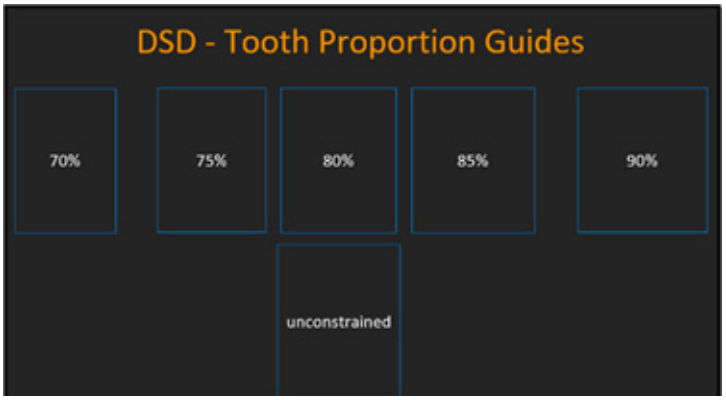

Figure 2: Extraoral analysis guidelines

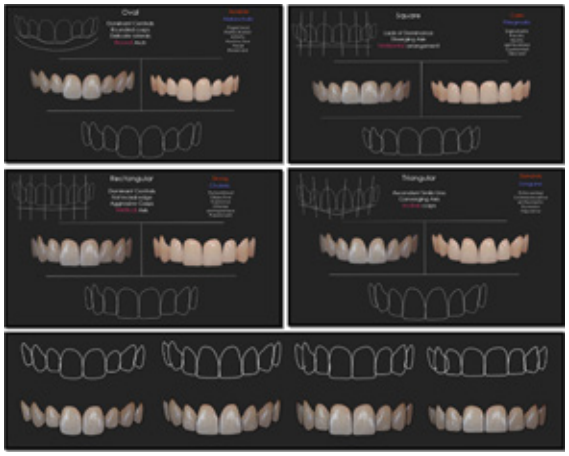

Figure 3: Smile Design Pretoria/Tooth Colored Fillings Pretoria

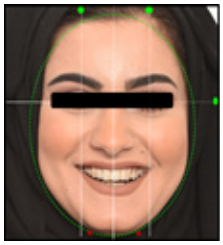

Figure 4: The facial photograph with a wide smile and the teeth apart is moved behind the cross to determine the ideal horizontal plane vertical midline and digital facebow

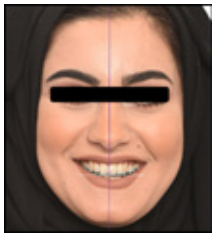

Figure 5: The photograph adjusted to the reference lines, with other lines can be added as needed to help visualize the esthetic issues and improve efficiency of communication.

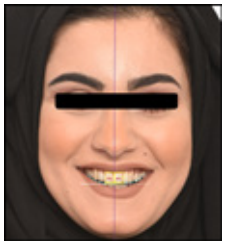

Figure 6: A rectangle with ideal length/width proportion (80%) is placed over the central incisors to compare the actual pretreatment proportion with the ideal one.

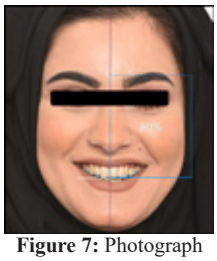

Figure 7: Photograph with the cross used to measure the actual length/width proportion of the left central incisor using tooth proportion guide.

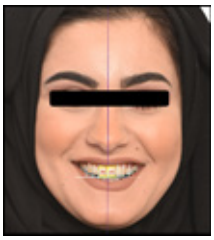

Figure 8: Photograph with the cross and dento-facial analyzer to optimize esthetic while preserving tooth structure.

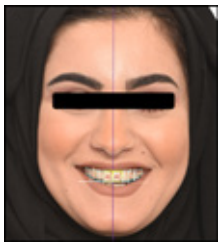

Figure 9: Photograph with the cross and two reference lines that represent the smile arc and gingival display

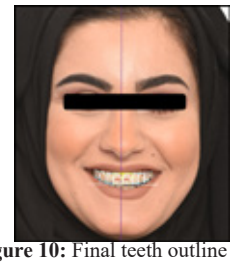

Figure 10: Final teeth outline showing the relation between the preoperative situation and the ideal design.

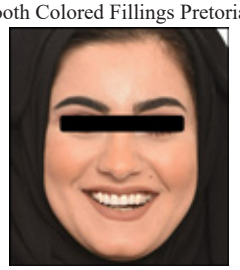

Figure 11: Final outcome after sitting of suitable digital shaded teeth.

Figure 12: Pre DSD (left) and post DSD (right) photographs

more satisfied with their expected outcomes when compared to females (Table 3). Participants with Class I and II incisors relationships showed almost equal percentages of satisfaction with DSD results, while participants with Class III incisors were less satisfied with the expected outcomes (Table 4). Participants with crowding were more satisfied with DSD results than those with spacing (Table 4).

DISCUSSION

Human face attraction depends on the balance between the face, gingiva, and dentition[9,10] Since there is growing demand of patients and the requests for esthetic rehabilitation, it is

Table 1: Distribution of incisor classification

Classification	Females		Males		Total	
	N	%	N	%	N	%
Class I	14	27%	14	27%	28	54%
Class II	11	21%	8	15%	19	375
Class III	1	2%	4	8%	5	10%
Total	26		26		52	

Table 2: Distribution of spacing and crowding within the sample

Malocclusion	Females		Males		Total	
	N	%	N	%	N	%
Spacing	7	13%	7	13%	14	27%
Crowding	19	37%	19	37%	38	73%

Table 3: Satisfaction with the expected outcomes according to gender

Gender	Minimum	Maximum	Average
Males	60%	95%	82%
Females	55%	95%	79%
Total	55%	95%	81%

Table 4: Satisfaction with the expected outcomes according to incisor classification

Incisor Classification	Percentage of Satisfaction
Class I	83%
Class II	80%
Class III	66%
Spacing	71%
Crowding	83%

necessary for clinicians to develop strategies to consolidate communication and avoid results that dissatisfy patients'/ clinicians' expectations[11].

The DSD is a multifunctional program that can improve the patient acceptance of the orthodontic treatment and its final results. The use of extraoral and intraoral digital photographs with references lines and other shapes broadens the dental team's diagnostic vision and helps assess the esthetic principles, limitations and risk factors of a given case[8]. This study is the first to utilize the DSD in orthodontic decision-making. Which in turn would influence patient's decision regarding commencing treatment. However, this should be as realistic as possible to match future results without providing any deceiving expectations. Therefore, participants with discolored teeth were excluded because the software could not mimic the discolored teeth; hence, using whiter teeth could confound the results. The benefit of DSD in clinical practice can be summarized in that it can be used to record and analyze the patient smile, teeth, facial proportions, and the dynamics between them to obtain a final compatible treatment design. Besides, the midline of the upper jaw and the right position and dimension of the upper anterior teeth can be determined with the DSD procedure. An intermediate DSD can be performed to check the treatment's proceed and whether it matches the DSD's final result sheets[3]. Charavet et al. (2019) concluded that DSD can be applied for complex orthodontic cases, especially in multidisciplinary treatment, as it enhances the predictability of treatment and improves communication between multidisciplinary teams[3].

The sample for this study was selected as quota sample, mainly from the age group mostly seeking orthodontic treatment in early adulthood. The gender was equalized to identify if any significant difference is present, since the study did not seek for the distribution of malocclusion within the community, so it was not aimed to reach the real distribution of gender.

The sample size was considered large since it is above 30 and within "the central limit theorem"[12,13].

Types of malocclusion in terms of incisors classification, crowding and spacing have shown a reasonable distribution with Class I the highest followed by Class II and Class III, respectively[14]. Similarly, for crowding and spacing where crowding is more common than spacing. Regarding the satisfaction with the design used for the expected treatment results, generally, 81% was reported, which can be considered as a very good result. Males reported slightly higher satisfaction (82%) than females (79%), following the common belief that females are more sensitive to the outcomes and usually seek perfection more than males. Regarding classification of malocclusion, participants with Class I showed the greatest satisfaction, followed by those with Class II and Class III, respectively. It can also be noted that the satisfaction for Class I and Class II was close compared to that for Class III. This may be explained by the difficulty of using the software when associated with complex cases, especially with Class III, where the incisors overlap was difficult to correct and reflected on the results. Participants with crowding were more satisfied with the DSD outcomes than those with spacing. This could be because crowding is more sensible and affects facial appearance more than spacing. Therefore, any minor improvement could satisfy the patient easily. This study introduced the use of DSD in orthodontics in the planning stage. This can be improved in the future to include more features and aid in improving patient's compliance as well. Additionally, a simple and modified method was used in this project to make the application of DSD easier for the practitioners.

CONCLUSIONS

This is the realistic expectation and adequate patient-orthodontist communication.

DSD is a useful tool in designing an orthodontic treatment plan and can be used as a visual aid to enhance patient's expectations, especially those who do not need complicated teeth movement (e.g. Class III malocclusion). Further studies using the DSD after adding more teeth shades and shapes to simulate the natural results are recommended.

Main points

- Digital smile design (DSD) can be used as a useful tool in designing the plan of orthodontic treatment.
- DSD can improve the diagnostic abilities, arrange treatment planning, improve patients' motivation and increase the efficiency case presentation.
- DSD aids to improve patient's compliance.

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