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Digital evaluation of smiles in angles Class-I, Class-II division-1 and Class-II division 2 cases based on hard tissue component of beautiful smile using Digital Smile Design software

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Abstract

Introduction: A beautiful smile is a facial expression of grave importance as it relates to communication and expression of one's own feelings and emotion. Planned orthodontic evaluation of smile using Digital Smile Design Software is helpful in determining the final

treatment goal of obtaining every criterion of the American Board of Orthodontics along with an esthetic smile.

Aim: To digitally evaluate smile based on hard tissue component in Class-I, Class-II division 1 and Class-II division 2 malocclusion.

Method- For each patient, a series of photographs required for DSD analysis will be performed. The facial aspects, smile harmony and dental characteristics will be evaluated. The hard tissue component of beautiful smile in Class-I, Class-II division-1 and Class II Division-2 cases is evaluated, compared and corrected accordingly.

Results- Chi square test, student unpaired t-test, students t test & ANOVA test will be utilised to analyse data. Comparison of the hard tissue component of beautiful smile in Class-I, Class-II division-1 and Class II Division-2 cases will be done usng t-test. When all parameters will be assessed norms for each cases will be obtained.

Conclusion- Digital evaluation of smile before beginning of any procedure can help to achieve treatment goals.

Keywords- Digital Smile design, Lateral negative space, Smile arc

INTRODUCTION

Oral health is an essential component of an individual's mental and physical health.[1] An oral cavity which is healthy empowers an individual so that he can perform routine activities of day to day life without any physical and social limitations.[2]Aesthetics is the main reason why a patient seeks orthodontic treatment and is the prime criteria for judging the quality of treatment imparted, making it a therapeutic success. Difficulty is always encountered in later stages of finishing and detailing where finishing bends are required to provide the desired esthetic results which become cumbersome to give in patients seeking orthodontic treatment[3]. Nowadays with the advent of Invisalign, clearalign and other modalities, which are preferred by adult patient, initial smile designing helps in planning treatment goals which are then conveyed to the relevant personnel for incorporating necessary corrections in the CAD-CAM to prepare series of trays.

In prosthetics planning and smile designing- Planmeca Romexis is used for full mouth rehabilitation and for planning size, shape and position of artificial crown or teeth so that appropriate designed crowns, veneers or abutments are designed[4].

The same software if used for evaluating the hard tissue components contributing to altered smile may be helpful in planning the final treatment goal for invisalign or invisalign like appliances.

In " Class-I " , " Class-II vertical " and " Class-II horizontal " malocclusion, the hard tissues may contribute differently and by using the above software, it may help in identifying the final hard tissue goals with an aesthetic smile and later may provide patient satisfaction thereby leading to therapeutic success.

Hence, this exploratory study has been planned on a single group to evaluate hard tissue component of smile in " Class-I ", " Class-II division 1 " and " Class-II division 2 " malocclusion.

Objective:

1. To digitally *evaluate* hard tissue component of smile in " Class-I ", " Class-II division 1 " and " Class-II division 2 " malocclusion.

2. To digitally *compare* hard tissue component of smile in " Class-I ", " Class-II division 1 " and " Class-II division 2 " malocclusion.

3. To digitally *correct* hard tissue component of smile in " Class-I ", " Class-II division 1 " and " Class-II division 2 " malocclusion.

4. To digitally *compare* the *variation and correction* required in hard tissue component of smile.

Material and Methods:

Study design: An observational study

After taking informed consent from the Institutional Ethics Committee, the present study will be conducted in the Department Of Orthodontics and Dentofacial Orthopaedics, Sharad Pawar Dental College, Sawangi (meghe), Wardha

The cases for the study will be selected from departmental OPD. Patient will be explained about the method and aim of the study being conducted and written consent from the patient will be obtained before examination and data will be entered in the structured Performa. Informed and written consent will be obtained from the selected patients.

Sample Size Calculation:

A pilot study of 3 patients was conducted.

Formula used is as follows:

$$n= 2sp^2 [Z_{1-\alpha/2} + Z_{1-\beta}]^2 / d^2$$

Where

- $Z_{1-\alpha/2}$ =1.96
- $Z_{1-\beta}$ = 0.84
- SP= SD_1+SD_2/2
- d = mean2- mean1

The pilot study was done on 3 patients and mean±SD of intrusion was calculated.

For Class-I patients it was 13.97±1.94

For Class-II patients, it was 15.57±1.79

Standard Deviation in class-I patients, SD_1= 1.94

Standard Deviation in class-II patients, SD_2= 1.79

SP= 1.94+1.79/2=1.865

SP^2= 1.865

Mean in class-I patients = 15.57

Mean in class-II patients = 13.97

d= mean2-mean1

d=13.97-15.57=1.6

d^2=2.56

n=2(3.5)(7.84)/2.56

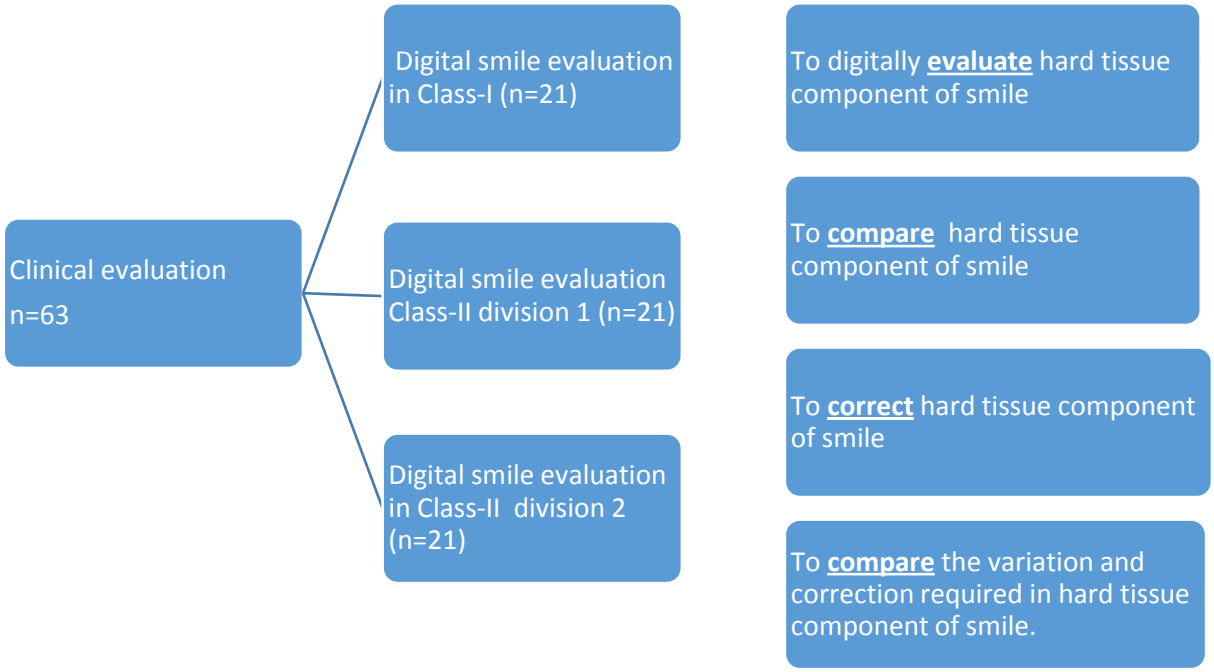
= 21.44

Sample size is 21 per group

Total 63 patients having Angles Class-I, Class-II division 1 and Class-II division 2 malocclusion in age group of 15-35, will be selected.

Equal no. of cases will be selected

- Group 1-21 dental class-I malocclusion
- Group2- 21 dental class-II division 1 malocclusion
- Group 3- 21 dental class-II division 2 malocclusion



Inclusion:

1. Patient with

i) Class-I malocclusion

ii) Class-II division 1 malocclusion

iii) Class-II division 2 malocclusion

2. Patient in the age group of 18-35years

Exclusion:

1. Patient having skeletal abnormalities

2. Patient having muscular dystrophy

3. Patient with systemic disease

Procedure

During the initial examination of the patient, the facial characteristics, harmony of smile and dental features will be evaluated. For each patient, a series of photographs required for DSD analysis were performed as follows[5]

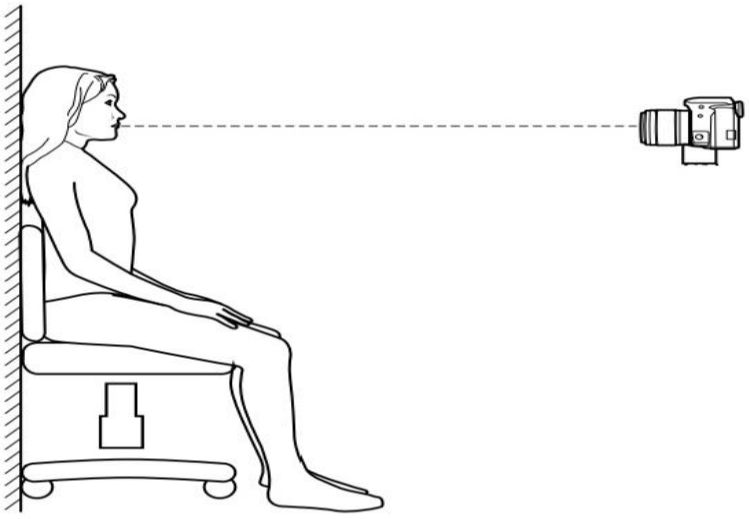
1. Frontal facial (Retracted and smile)

2. Intraoral front

3. Intraoral front (with 3-4mm mouth opening)

Software: Planmeca Romexis

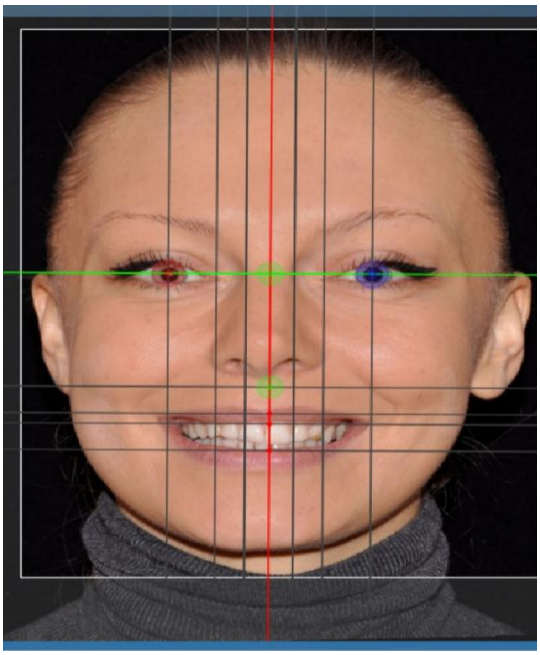
Capturing images for smile design



For digital smile designing a frontal facial photograph is taken along with a retractor image is to properly visualise the gum line in the smile photograph.

The shadows of the patients is avoided by positioning them against the wall. The camera is kept perpendicular to the patients face and the images are captured from the front of the

patient. The face of the patient is kept straight facing the camera so that both the ears are visible while capturing the image.



The images of each patient will be saved under the patient's name and OPD no. in JPG formats and imported into the software. The image is aligned to horizontal using two points i.e. pupils. The line joining the two pupils i.e, the interpupillary line will serve as an initial reference which will help to formulate the horizontal plane, i.e. digital face bow.

The alignment of horizontal grid lines are as follows.:

- The superior border of upper lip corresponds to the highest line.
- The inferior border of upper lip corresponds to the middle line.
- The superiorr border of the lower lip corresponds to the lowest line.

After the necessary adjustments are done, the image is calibrated using the calibrate button in smile design group. After calibration the silhouette is correctly positioned onto the image. The intrusion, extrusion, translation, rotation, angulations of individual tooth is modified according to the planned treatment.

Vital elements for Smile Designing (dental composition)[6][7][8]

1. Vertical dental height
2. Incisor inclination
3. Smile arc
4. Lateral negative space
5. Alignment of tooth
6. Midline

The outcome of pre and post orthodontic treatment smile evaluation will be saved.

A standard smile design case report is created in PDF format using the final image.

The final case report is shown to the patient and the treatment plan is explained.

Statistical Analysis:

Stastical analysis can be done by using Descriptive & inferential statistics using chi square test, student unpaired t-test, students t test & ANOVA test.

Software using analysis will be SPSS22:0 version & graph pad prism 6.0 version & $p < 0.05$ is considered as level of significance.

Result: Smile arc, lateral negative space and midline will give the primary outcome which will be compared among the different malocclusion that will provide a cpmparative norm of hard tissue among them. Whereas the other parameters such as vertical dental height, incisor inclination and alignment of tooth will give the secondary objective

Scope:

1. A predictable treatment plan can be established using Digital smile design.

2. Establishing and explaining realistic expectation helps patient to feel engaged and included in the treatment plan.

Limitations

1. Digital smile designing set up a high expectation for the patient which may or may not be satisfactory to the patient at the end of the treatment.

2. Only dental hard tissue component of smile can be modified using the above software.

Discussion

Smile is an expression which mainly contributes to facial attractiveness. An attractive or pleasing smile increases the possibilities of acceptance of a person in the society by improving social relationships. The standard of life and one's success is highly dependent on facial attractiveness. The attractiveness can affect teacher-student and student-peer relations and academic attainment. The modern society, a pleasant smile increases job opportunities, social interactions and even in spouse selection. Adolescent patients and their parents accept orthodontic treatment to improve oral and dental functions, health and aesthetics and to enhance self-confidence and the quality of their social life. For many people their imperfect smile causes them a great deal of embarrassment. This makes talking to strangers difficult and results in poor self-esteem which is disastrous for young people on the cusp of adulthood. Success in every day to day life situations provides the confidence to smile to the fullest.

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