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The Effect Of Various Skeletal And Dent Alveolar Parameters On Smile Esthetics In Different Malocclusion Groups

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Abstract

Materials and Method: 60 subjects in age range of 17 -25 years were selected and skeletally divided into group I and II on the basis of Beta angle, ANB angle and Wits appraisal. Group II was further subdivided into 2 groups on the basis of Angle's classification of malocclusion. Various skeletal and dental parameters were measured on cephalogram and smile measurements were made on facial photographs in Adobe photoshop. Various statistical tests were applied for assessment and comparison of various skeletal and dentoalveolar parameters and their correlation with smile esthetics were in different malocclusion groups.

Keywords: Mesenchymal cells, implants

Introduction

Smile is an expression, used to convey a sense of compassion and understanding. It is the cornerstone of social interaction.¹ The "art of smile" lies in the clinician's ability to recognize and enhance the positive elements of beauty in each patient. Smiles can be either posed or

spontaneous.² Peck and Peck³ classified smiles as stages I and II. Ackerman et al⁴ classified smiles into two basic types: the social smile and the enjoyment smile. Each type involves a different anatomic presentation of the elements of the display zone. In the anatomy of smile the upper and lower lips frame the display zone of the smile. Both skeletal and dental relationships contribute to smile components. Smile style is another soft-tissue determinant of the dynamic display zone. There are three smile styles: the cupid smile, the complex smile, and the commissural smile.⁵ An individual's smile depends on the direction of elevation and depression of the lips and the predominant muscle groups involved.⁶ Smile characteristics are determined by the interplay of static and dynamic relationships between the dentoskeletal and soft tissue components of the face. Hence, the present study was planned to evaluate the influence of various skeletal and dentoalveolar parameters on smile esthetics in different malocclusion groups.

Material and Methods

Sample for the present study consisted of 60 young adults within the age range of 17-25 years. The sample was scrutinized from patients coming to the OPD of the Department of Orthodontics. Selected individuals ranged in 17-25 years with no previous history of orthodontic treatment, significant skeletal asymmetry, anterior or posterior cross bite, missing or malformed teeth, any maxillofacial surgery or anterior maxillary prosthodontic rehabilitation. The study was approved by the Institutional Ethical Committee, and informed consent was obtained from all participants.

The subjects were skeletally divided into two groups on the basis of sagittal cephalometric parameters viz. Beta angle, ANB angle, and Wits appraisal. The division of subjects into Group I and Group II were done on the basis of satisfying at least any two of the three previously mentioned parameters. There were total number of 20 subjects in Group I and 40 subjects in Group II (Table 1). Group II (40 subjects) were further subdivided dentally into two groups on the basis of Angle's classification of malocclusion into Group IIa (Angle's Class II div 1 malocclusion) and Group IIb (Angle's Class II div 2 malocclusion) (Table 2)

Four facial photographs were recorded, compared and analyzed including full face photograph at rest, close up photograph at rest, close up smiling photograph and frontal occlusal photograph. The photographic setup customized for the present study was a tripod stand (figure 1). All photographs were captured with DSLR {CANON 1300D (W)} camera from a standard distance of 24" for full face and 12" for close up photographs to obtain quantitative and qualitative data. To get natural unstrained social smile position, each subject was requested to present their full smile a few times and image was captured when subject successfully repeated the full smile

pattern. The photographic setup customized for the present study was a tripod stand.

The closeup photographs were cropped to eliminate most of the nose and cheeks in order to minimize the influence of background attractiveness. For calibration the digital photographs were imported into a commercially available photo editing program (Adobe Photoshop, version 7.0) and were accurately calibrated before recording any measurement. Horizontal and vertical grid lines were used for all measurements. The grid lines were placed on defined hard and soft tissue landmarks. The following parameters of smile esthetics were evaluated (Table 3, Figure 2 - 4). All measurements were recorded to the nearest of 0.5mm.

The lateral cephalograms in occlusion for the study subjects were obtained in natural head position and were traced manually on acetate tracing sheet with sharp 3H pencil on a view box. The various hard and soft tissues cephalometric landmarks were identified and marked. The hard tissue landmarks, linear and angular measurements were marked on the cephalograms. For the measurements of linear distances, scale to the nearest of 0.5 mm and angles to the nearest of 0.5° were used. Following landmarks and measurements were used: (Table 4, Figure 5 – 8).

The data obtained was analysed with conventional, descriptive statistics. All the analyses were performed with commercial statistical software SPSS (Statistical Package For The Social Sciences) version 17.0. Data were summarized as mean (standard deviation). Groups were compared by one-way analysis of variance, and the significance of mean difference between (inter) groups was done by Tukey's post hoc test. Categorical groups were compared by chi-square test. Correlations between various smile parameters and various skeletal and dentoalveolar parameters was done by Pearson correlation

and further analyzed by Multiple regression analysis. P value less than .05 ($P < .05$) was considered statistically significant.

Results

Assessment and comparison of various skeletal and dentoalveolar parameters in different malocclusion groups showed statistically significant differences in Basal plane angle (Pal-MP) ,1-Palatal plane angle (1-Pal plane) and Interincisal angle (\angle ii). (Graph 1)

Assessment and comparison of parametric smile characteristics in different malocclusion groups showed statistically significant differences in upper lip length, maxillary incisal display at rest, morley ratio, maxillary incisal display at smile and modified smile index. (Graph 2)

Assessment and comparison of non- parametric smile characteristics i.e. facial index, lip sscompetency, smile arc, smile style and smile pattern in different malocclusion, only lip competency showed statistically significant differences. (Graph 3)

Correlation of smile parameters with various skeletal and dentoalveolar parameters in Group I subjects, statistically significant positive correlation of upper lip length, maxillary incisal display at rest, morley ratio, modified smile index was found. (Table 5 and 6)

Correlation of smile parameters with various skeletal and dentoalveolar parameters in Group IIa subjects showed significant correlation with upper lip length, maxillary incisal display at rest, maxillary incisal display at smile. (Table 7 and 8)

Correlation of smile parameters with various skeletal and dentoalveolar parameters in Group IIb subjects showed significant correlation with upper lip length, maxillary incisal display at rest, gingival display at smile, modified smile index. (Table 9 and 10)

Discussion

Smile is a representation of the dynamic relationship of perioral soft tissue with underlying skeletal and dental components.⁷ Different skeletal patterns has characteristic dentoalveolar features that affect smile.

The present study was undertaken to assess the relationship between different skeletal, dental and soft tissue structures and configuration of the smile in patients with various degrees and types of malocclusions in the anteroposterior and vertical dimensions. These results apply to the subjects before orthodontic treatment when possible problems of alignment were part of the overall evaluation of the smile characteristics. Knowledge of the correlation between the hard and soft tissue anatomy and smile esthetics can add important clinical meaning to orthodontic diagnosis and treatment planning.

Many studies have reported age related variations⁸ in smile characteristics. To eliminate the effect of these factors, we evaluated the smile dynamics of individuals aged between 17 – 25 years. We were not able to study sexual dimorphism in smile variables as the study sample size was small and unequal when divided further into gender basis.

The comparison of upper lip length between different malocclusion groups showed statistically significant differences. The maximum value of upper lip length was recorded in class II div 2 malocclusion subjects and least in class I malocclusion subjects. ULL is one of the important factors that determine the amount of maxillary incisal and gingival exposure during smiling and speech.^{9,10} Short upper lip length has been considered a suspect in producing gingival smile line, and controversial data exist in the literature regarding this. Although Peck et al³ found no difference in upper lip length between the gingival smile group and reference groups, Miron et al¹¹ observed short ULL in participants with high smile line.

Our results were against the study by Alkahalaf¹² who showed that upper lip length at rest in Class I was higher compared with other groups and Rakosi¹³ who showed that Class II have shorter upper lip than Class I subjects.

In the present study the maxillary incisal display at rest and smile was found maximum in class II div 1 malocclusion subjects and least in class II div 2 malocclusion subjects. The comparison between different malocclusion groups showed high statistically significant differences. Maxillary incisal display during smile is affected by hard tissue factors, such as vertical maxillary height, dental height, and soft tissue factors, such as lip length and lip elevation.¹¹ In a study by Siddiqui et al⁷, they showed positive correlation of maxillary incisal display at smile with facial height and upper incisor to palatal plane angle. Therefore, it can be implied that increased incisal display during smile is a result of a combination of increased skeletal as well as increased maxillary dental height but more closely associated with the increased elevation of the upper lip in individuals with a horizontal skeletal pattern. Our findings are in contrary with findings of Sarver and Ackermann⁶ who reported that incisor proclination dramatically affects incisor display. Flared maxillary incisors tend to reduce incisor display, while upright maxillary incisor tend to increase it. Morley ratio was found maximum in class II div 1 malocclusion subjects and least in class II div 2 malocclusion subjects. The comparison of Morley ratio between different malocclusion groups showed high statistically significant differences. This finding can be correlated to the maximum incisal display in Class II div 1 and least in Class II div 2 malocclusion group subjects.

Modified smile index was recorded maximum in class II div 1 malocclusion subjects and least in class II div 2 malocclusion subjects. The comparison of Modified smile index between different malocclusion groups showed high

statistically significant differences. This can be related to increased maxillary incisal exposure at smile in Class II div 1 patients as compared to Class II div 2 patients.

Assessment and comparison of posterior corridor in different malocclusion groups revealed no statistically significant differences; but it was maximum in Class II div 1 and least in Class I malocclusion subjects. This can be attributed to narrow v- shaped arches in Class II div 1 malocclusion subjects. According to Sarver and Ackerman¹⁴ a patient with a retrusive maxilla can have large buccal corridors. Although the maxilla may be of normal width the buccal corridors might be more prominent because the wider portion of the arch is placed more posteriorly. Transverse smile dimension, therefore, is a function of both arch width and anteroposterior position of the maxillary and mandibular arches.

In the present study assessment and comparison of change in upper lip length on smiling in different malocclusion groups was maximum in Class II div 2 and minimum in Class II div 1 malocclusion but revealed no statistically significant differences may be because the protrusion of the upper incisors in Class II cases causes decreasing of the lips elasticity and the muscles' ability to raise the upper lip. Islam et al¹⁶ found that the upward movement of the upper lip in Class II div 1 subjects was smaller in comparison with the Class I subjects. Change in upper lip length is primarily a function of activity of upper lip musculature. A positive correlation was found between the upper lip length and the change in upper lip length on smiling, which implies that longer the upper lip the more it elevates during smile. The same observation was also made by Miron et al¹² who found the positive correlation between the lip length and lip elevation.

The maximum subjects with competent lips were recorded in class II div 2 subjects and least in class II div 1 subjects. The differences between the different

malocclusion groups were statistically significant. This can be attributed to the fact that the incisors are retroclined in Class II div 2 patients, so tendency for competent lips is more. Moreover, these group patients have maximum upper lip length. The flaring of maxillary incisors decreases the ability of lips to close. Also shorter upper lip contributes to lip incompetency.

Maximum numbers of subjects with consonant smile arc were in Class II div 1 and minimum in Class I malocclusion which can be attributed to increasing the cant of the maxillary occlusal plane. The differences in smile arc between different malocclusion groups were not statistically significant which is consistent with the findings by Kakadia et al.¹⁷

Although there are millions of different smiles but three basic smile styles can be identified i.e. commissural, cuspid and complex smile styles. Commissural smile style is the most acceptable socially. Assessment and comparison of smile style in different malocclusion groups revealed no statistically significant differences. The maximum value of commissural smile style was found in Class II div 2 subjects, maximum value of complex smile style was found in Class I malocclusion subjects and maximum value of cuspid smile style was found in Class II div 1 subjects. This can be attributed to the respective activation of the different muscle groups in different smiles.

Smile pattern (lip line) is the height or position of upper lip relative to the maxillary central incisors on smiling. It was found to be statistically insignificant difference between smile pattern in different malocclusion groups. Maximum number of patients presented with average smile line in all the malocclusion groups.

Smile analysis is a complex and difficult procedure. Dynamic alteration of smile is influenced by several factors. The advantage of using a frontal facial photograph

for analysis in this study was simple and cost effective. There was a difficulty in obtaining a natural smiling photograph. Because the patients did not have a well aligned occlusion before orthodontic treatment. Several factors may not be visible in frontal smiling photographs. The problem of excessive positive or negative overjet is not as apparent in frontal smiling photographs.¹⁸ In future different views of smiling photographs have to be assessed to ensure a comprehensive smile analysis. Also error is associated with election of the appropriate still frame representing the posed smile.

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