ORIGINAL ARTICLE

# COMPARISON OF MICRO-AESTHETICS PARAMETERS WITH DENTAL MALOCCLUSION AND FACIAL HEIGHT AMONG ORTHODONTIC CASES: A CROSS SECTIONAL STUDY

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## ABSTRACT

*Maxillary anterior teeth proportion and display has a special value in dental aesthetics. This study was done to assess the micro-esthetic parameters of maxillary anterior teeth and their possible association with lower anterior facial height and dental malocclusion types. Pre orthodontic records of 180 cases were selected. Molar relationship Class I, II and III were examined on plaster models and Micro-Aesthetic Parameters (Crown length, width, width length ratios, scallop depth and gingival aesthetic line) were assessed on plaster models using Digital Vernier Calliper. The lower anterior facial height was measured on lateral Cephalogram using software (View box 4TM). Micro aesthetic parameters were compared with malocclusion and face height types using one-way ANOVA and Tukey test. Most of the samples had Class II (90%) followed by Class I molar relationship (69%) and Class III (21%) relationship. The mean lower anterior facial height for Normodivergent, Hyper divergent and Hypo divergent was 83.3%, 12.7%, 3.3% respectively. The width/length ratios were found to be greater than 80% in 79% of the sample. Micro-esthetic parameters had no significant association with lower anterior facial height or malocclusion types. Width length ratios of maxillary anterior teeth and other micro aesthetic parameters were statistically different from their ideal values. Micro aesthetic parameters also showed no significant association with lower anterior facial height and dental malocclusion types.*

**Keywords:** *Micro-esthetics, Skeletal Face height, Dental Malocclusions.*

## INTRODUCTION

Orthodontic treatment is aimed not only to improve balance and function of the stomatognathic system but also esthetics.[1,2] With increase in awareness about aesthetics in general population the dental professionals are searching ways to make teeth better in appearance. Facial and dental appearance has been broadly categorized into Macro, Mini and Microesthetics.[3]

Micro-aesthetics includes tooth proportions in height and width, gingival shape and contour, connectors and embrasures, black triangles, and tooth shade. Maxillary anterior teeth are visible during smile. All these components precisely determine the appearance of harmonious and symmetric orthodontic finished smile.[4] They play a pivotal role in the overall facial appearance of a person and social beauty.

In an orthodontic patient ideal smile esthetics cannot be achieved unless all the components of smile are deeply analyzed before and during orthodontic treatment. Successful treatment outcome in terms of function and esthetics is an interdigitation of harmonious tooth proportion and ideal gingival morphology i.e. white esthetics (tooth proportion) and its relationship with pink esthetics (gingiva).[3]

The literature, however, has an on-going wide debate about the role of ideal tooth ratios for improving smile aesthetics.[2] This ratio varies according to race, gender and ethnicity. Several studies have been conducted to relate facial aesthetics with dental aesthetics through intercanthal and inter commissure width, internasal bizygomatic, intergonial distances, malocclusion types and extraction vs no extraction treatment approaches.[4-7]

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Despite that prevalence data, the impact of facial height and malocclusion on micro aesthetics is scarce in this population. Therefore, this study was aimed to find the association between malocclusion, facial height and tooth proportions and other micro aesthetic parameters. It will help in emphasizing and focussing on the importance micro aesthetics in treatment planning and finishing stages in orthodontic treatment.

## MATERIAL AND METHODS

This study was conducted at the orthodontic department, Rehman College of Dentistry (RCD), Peshawar in 2018 after the approval by ethical committee. Pre orthodontic records (Plaster models and Lateral Cephalograms) of 180 patients were used to evaluate different variables.

Patients with age range 12-22 years, good quality plaster models, complete set of anterior teeth (maxillary central incisors (#8 and 9), lateral incisors (#7 and 10), and canines (#6 and 11), good oral hygiene, dental malocclusion (molar I, II, III), skeletal class I and mild skeletal II, III were included in the study. Whereas patients with worn, restored, missing, malformed and various dentofacial deformities were excluded.

Micro aesthetic parameters of crown length, width, width length ratios, scallop depth and gingival aesthetic line were measured on plaster models using Digital Vernier Calliper (Figure1). Dental Malocclusion Molar Class I, II and III were examined on the plaster models. Facial height (AFH Normal 54%±4, low <50%), high >58%) was measured from Lateral cephalograms digitized on software View Box 4™.

The ideal clinical crown lengths (edge to gingival margin) were set at 11 to 13 mm for central incisor and canines and 10 to 12 mm for the lateral incisors as suggested by McGuire.[8]

Width length ratio followed the golden proportion 80% (normal) and values <68 % and > than 80 % revealed long and short crown respectively.[9]

Gingival aesthetic line (GAL) was drawn from gingival margin of central incisor to the gingival margin of the canine and then vertical distance to the lateral incisor 1 to 2mm (Normal), > 1mm coronal and apical to GAL was calculated from GAL for both right and left side.[10]

For the Scallop depth measurements were made from the gingival margin to a horizontal line drawn between the tips of the papillae on either side of the teeth on the frontal view.[10] All the measurements were made by a single operator.

The statistical analysis was done using the SPSS version 20. Means and standard deviations were measured for all the quantitative data. Comparison between micro aesthetic parameters, facial height and dental malocclusions were calculated using One-way ANOVA and Tukey test. Statistical significance was set at p<0.05.

## RESULTS

Total sample consisted of 180 subjects comprising 80 males and 100 females with a mean age of 15.78.

Most common Dental malocclusion was Class II (90%) followed by Class I (69%) and Class III (21%). Mean Anterior Face height found was 55.2%. Normodivergent category was found to be most prevalent followed by hyperdivergent and hypodivergent (83.3%, 12.7 % and 3.3%) respectively.

Mean Crown lengths of anterior sextant are shown in (Table 1). Width/ length ratio of teeth ranged from 89.7% to 91.2 % (Table 2). Only 1.48% of the total sample showed the scallop depth > 4 mm (Table 3). In our sample 62.7 % of the lateral incisors were within 0.5 to 1 mm of GAL (Table 4). Almost 79% teeth exceeded the ideal W/L ratio in our sample (Table 5).

When facial proportions were compared with micro aesthetic parameters no significant association was observed with most of the variables except GAL. Both minimum and maximum significant values were found in hypodivergent group 2.17 mm ,1.17 mm for right and left sides respectively. Scallop depth was less than 2 mm in all three groups with the highest value of 1.67 mm in the hypodivergent group. W/L ratios also exceeded the ideal value, maximum value was found to be for tooth # 7 (93.7%) in hyperdivergent group (Table 6).

When malocclusion types were compared with the micro aesthetic parameters, results were insignificant. It was observed in all groups GAL was more than 1 mm but less than 2 mm both on the right side and left sides. Highest mean was on right side in Class II (1.52 mm) and highest mean on left side was for Class I (1.55mm). Scallop depth was less than the ideal value in all groups and highest value was 1.66 mm in Class II



Fig 1: (Digital Vernier Calliper)

TABLE 1: IDEAL AND MEAN CROWN LENGTHS

| Tooth # | Ideal length mm | Mean length | SD |
|---|---|---|---|
| 6 | 11 to 13 | 8.70 | 1.25 |
| 7 | 10 to 12 | 7.44 | 1.09 |
| 8 | 11 to 13 | 9.53 | 0.95 |
| 9 | 11 to 13 | 9.54 | 0.90 |
| 10 | 10 to 12 | 7.55 | 1.14 |
| 11 | 11 to 13 | 8.78 | 1.37 |

TABLE 2: MEAN CROWN WIDTH /LENGTH RATIOS IN EACH TOOTH

| Tooth # | W/L ratio | SD |
|---|---|---|
| 6 | 90.0 | 13.0 |
| 7 | 91.2 | 15.2 |
| 8 | 89.9 | 9.75 |
| 9 | 89.9 | 9.97 |
| 10 | 89.8 | 13.1 |
| 11 | 89.7 | 14.6 |

TABLE 3: SCALLOP DEPTH FREQUENCIES IN EACH TOOTH

| | 0-2mm | 2-4mm | >4mm |
|---|---|---|---|
| 6 | 98 | 74 | 8 |
| 7 | 128 | 58 | 1 |
| 8 | 99 | 81 | 0 |
| 9 | 100 | 76 | 1 |
| 10 | 128 | 52 | 0 |
| 11 | 114 | 60 | 6 |

Ideal scallop depth = 4.5 to 5mm

TABLE 4: FREQUENCY OF DISTANCES OF LATERAL INCISORS TO GAL

| | Relationship of lateral incisor with GAL | | |
|---|---|---|---|
| | 0 to 1mm N (%) | >1mm Coronal to GAL N (%) (%) | Apical to GAL N (%) |
| Right | 116(64.4) | 51 (28.3) | 13(7.2) |
| Left | 110 (61.1) | 56 (31.1) | 14(7.8) |

Ideal = 0-1 mm coronal to GAL

TABLE 5: WIDTH/LENGTH RATIOS OF TEETH SHOWING SHORT/NORMAL AND LONG CLINICAL CROWN LENGTHS

| Tooth # | <80 | 80 to 100 | >100 |
|---|---|---|---|
| 6 | 47 | 98 | 35 |
| 7 | 39 | 100 | 39 |
| 8 | 24 | 131 | 25 |
| 9 | 27 | 123 | 30 |
| 10 | 49 | 98 | 33 |
| 11 | 40 | 111 | 29 |

TABLE 6: INTER GROUP COMPARABILITY EVALUATION OF VERTICAL FACE HEIGHT WITH MICRO AESTHETICS (ONE- WAY ANOVA WITH TUKEY TEST)

| Variables | Hypodivergent | Norm divergent | Hyperdivergent |
|---|---|---|---|
| (N) | 6 | 151 | 23 |
| GAL R | 1.17* | 1.39 | 1.74* |
| GAL L | 2.17* | 1.44* | 1.48* |
| SD 6 | 1.67 | 1.50 | 1.48 |
| SD7 | 1.5 | 1.38 | 1.35 |
| SD8 | 1.17 | 1.45 | 1.52 |
| SD9 | 1.20 | 1.71 | 1.57 |
| SD10 | 1.67 | 1.26 | 1.35 |
| SD11 | 1.33 | 1.38 | 1.52 |
| W/L ratio 6 | 86.0 | 90.3 | 89.1 |
| W/L ratio 7 | 90.2 | 90.8 | 93.7 |
| W/L ratio8 | 85.6 | 90.2 | 89.2 |
| W/L ratio 9 | 90.8 | 89.7 | 90.6 |
| W/L ratio 10 | 92.4 | 89.8 | 89.4 |
| W/L ratio 11 | 92.5 | 90.2 | 86.0 |

$P < 0.05*$

group. Width/length ratio was >80% in all three groups and highest values found was (97.9 %) for tooth #7 in Class III Malocclusion (Table7).

## DISCUSSION

This study was undertaken with the aim of assessing the micro esthetic parameters of maxillary anterior teeth and finding its association with lower anterior facial height and different malocclusion types.

Most of the samples in present study had Class II molar relationship followed by Class I and Class III. Most of the epidemiological studies in different populations have shown prevalence of Class I malocclusion followed by Class II and III suggesting variation with ethnicity and gender.[11,12] Similar to this study, few

TABLE 7: INTER GROUP COMPARABILITY EVALUATION OF MALOCCLUSION WITH MICRO AESTHETICS (ONE - WAY ANOVA WITH TUKEY TEST)

| Variables | I | II | III |
|---|---|---|---|
| (N) | 69 | 90 | 21 |
| GAL R | 1.35 | 1.52 | 1.29 |
| GAL L | 1.55 | 1.39 | 1.52 |
| SD 6 | 1.48 | 1.53 | 1.43 |
| SD7 | 1.49 | 1.29 | 1.43 |
| SD8 | 1.39 | 1.49 | 1.48 |
| SD9 | 1.45 | 1.66 | 2.48 |
| SD10 | 1.25 | 1.32 | 1.24 |
| SD11 | 1.30 | 1.48 | 1.38 |
| W/L ratio 6 | 89.9 | 89.5 | 92.3 |
| W/L ratio 7 | 91 | 89.7 | 97.9 |
| W/L ratio8 | 90.3 | 88.7 | 94 |
| W/L ratio 9 | 88.9 | 89.9 | 92.8 |
| W/L ratio 10 | 90.8 | 88.8 | 91.2 |
| W/L ratio 11 | 90.3 | 90 | 86.8 |

$P < 0.05$*

prevalence studies conducted in Pakistan revealed Class II malocclusion to be more common compared to class III.[13,14] In present study the ratio of females was found to be more compared to males. According to literature females are found to be more concerned about aesthetics and ratio of seeking orthodontic treatment is also more as compared to the males.[13] In the current study mean values of tooth length varied from the ideal set values with a mean of 8.70 mm and 9.54 mm right and left central incisor respectively. The width length ratio of anterior sextant in this study was observed to be in the range of 89.7 to 90%. The width /length ratio was 89.9% for both right and left central incisors and 85.8% of the Central incisors exceeded the ideal width/length ratio. According to Wolfart et al[15] W/L ratio of maxillary central incisors within the range of 75-85% was considered most attractive. Konikoff et al[16] in their study on post treatment plaster models observed the crown width-to-height ratio of the maxillary central incisors to be in the range 90 - 94%. In their study 80% to 90% of central incisors from their sample exceeded the allowed 80% tooth width-to-height ratio. In one study conducted in Pakistani population comparing extraction and non-extraction sample, 51% percent of the central incisors exceeded the ideal tooth width-to-height ratio. In contrast to the non-extraction group, where the width/length ratio was maintained at the pre-treatment value an increase in tooth proportion was found in extraction group.[4] In another study conducted on orthodontic models in Pakistan W/L ratio of central incisors was 92% and it was found that 84 % exceeded the ideal value.[17]

According to Townsend et al the ideal scallop depth should be 4.5 to 5mm. This is synonymous to the papillary height therefore one half of the papillary height is also taken as a guide to measure the scallop dept.[10] In this study only 1.48% % of teeth showed the scallop depth >4mm for the mean length of teeth 8.78 mm. In one study 16.5 % of the teeth showed the scallop depth >4mm in their study mean length of central incisors was 9.3 to 9.4 mm. 4 mm Papillary height was short for that crown height.[16]

In the present study 69.7 % of teeth were within 1mm of GAL. 59.4 % were found to be >1mm of GAL and only 15%were apical to the GAL. According to Konikoff et al only 45% of the teeth were with the desired range.[16] In another study conducted in Pakistan both extraction and non-extraction sample, 33% lateral incisors were reported to be between 0.5 to 1mm.[4]

In this study face Normodivergent cases were most prevalent followed by hyperdivergent and hypo divergent. When face height was compared with micro esthetic parameters no correlation was found. Face height only showed significance with GAL in normo, hypo and hyperdivergent groups. These results were in accordance with a similar study conducted by Gyawali et al in which negligible correlation was seen between tooth and face proportions. In the present study mean percentage of face height was 55 % and, in their study, mean length was 62.28 mm. Like other studies conducted the past no correlation was seen in our study with malocclusion.[7]

Current study involved other parameters of micro aesthetic besides W/L that helped us in understanding whether any correlation existed between white and pink esthetics or not besides face height. The limitation of the study was that the sample size was small. In future the shape of the arch and other facial parameters can also be taken into consideration.

There are certain set ideal values within some accepted ranges that could be used in conjunction with other aesthetic parameters during diagnosis, treatment planning while reconstructing a natural smile with orthodontic treatment.

## CONCLUSION

Width length Ratios and other micro aesthetic parameters of maxillary anterior teeth were different from the ideal value in almost 2/3rd of the sample. Micro aesthetics variables also showed no significant

association with lower anterior facial height and dental malocclusion types.

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| CONTRIBUTIONS BY AUTHORS | |
|---|---|
| 1  **Ayesha Iftikhar:** | Concept, wrote article. |
| 2  **Khumara Roghani:** | Data Analysis, Draft Correction. |