Is the Posed Smile Contingent on Sexual Dimorphism? – A Cross Sectional Study

ABSTRACT

Introduction Smile evaluation has become an integral part of the clinical examination. The objectives of this study were to evaluate posed smile in males and females for Morley’s ratio, buccal corridors, smile arc and difference in esthetic perception between dental specialists and laypersons.

Methods 40 subjects (20 males and 20 females) were chosen and frontal smiling photographs of the subjects were cropped with the vertical limit from the nose tip to the soft tissue pogonion and transverse limit between perpendicular lines drawn down from zygomatic prominence on each side. The pictures were used to evaluate buccal corridor widths, Morley’s ratio, the consonance of the smile and attractiveness of the posed smile as perceived by dental specialists and laypersons using VAS scale.

Results The Morley’s ratio was found to be more in females than males and so were the consonant smile arcs. There was a high correlation between right and left buccal corridor measurements in both sexes. There was no difference in perception of dental specialists and laypersons.

Conclusions Consonant smile arcs result in more aesthetic smiles while buccal corridors seem to have no effect. Better VAS scores were observed in subjects with increased Morley’s ratio.

KEYWORDS smile, perception, dental specialists, laypersons, buccal corridor, Morley’s ratio

INTRODUCTION

Facial attractiveness is an important variable in the formation of first impressions and a person’s smile plays a major role in making the face attractive. Smile is the cornerstone of social interaction and enhances the personality which further influences the performance and opportunities presented to an individual. In orthodontics increased importance is being given to soft tissue paradigm during diagnosis and treatment planning and smile analysis forms an important part of this as the patients are more concerned about aesthetics than before.

Smile is defined as facial expression characterized by upward curving of the corners of the mouth, is often used to indicate pleasure, or amusement. Ackerman et al. have defined two types of smile: Posed smile and Duchenne smile (Fig. 1). A social smile is the voluntary smile a person uses in social settings or when posing for a photograph and it is not elicited by emotions. This smile can be sustained as a static facial expression and does not appear strained. On the other hand, enjoyment smile is unposed and reflects the emotions that one is experiencing at that moment. This smile appears strained because the mouth bursts forward to reveal the maximal expansion of the lips and it cannot be sustained. The posed smile has been referred to as a reliable reference for measurement and characterization of smile as it is repeatable over time.

Evaluation of the smile before orthodontic treatment helps to set the goals which need to be achieved during treatment. Examination of the smile framework (mini-esthetics), which is bordered by the upper and lower lips on smile animation, includes assessment of excessive gingival display on smile, inadequate anterior tooth display, inappropriate gingival heights, transverse width of the smile including buccal corridors and the smile arc.

The smile arc is defined as the contour of the incisal edges of the maxillary anterior teeth relative to the curvature of the lower lip during a social
smile. When the incisal margins of the maxillary central incisors appear below the canine cusps, the smile arc has a convex aspect that can harmonize with the lower lip line. On smiling if the maxillary anterior edges are parallel to the upper border of the lower lip then the smile is known as consonant (Fig. 2). If the 2 are not parallel with flatter maxillary incisal curvature to the upper border of the lower lip it is called a non-consonant smile (Fig. 3). Non-consonant smile is accompanied by a reverse smile arc which results when the canine cusps appear more occlusal than the maxillary central incisor tip margin, creating a concave aspect.

The buccal corridor (Fig. 4), or negative/black spaces, are the spaces created between the facial surface of the posterior teeth and the lip corners when the person smiles, giving depth and a natural aspect to the smile. This negative space is affected by the smile, the maxillary arch width, the facial muscles, the position of the buccal surfaces of the posterior maxillary teeth, maxillary antero-posterior position related to the lips. Excessively wide buccal corridors are considered unaesthetic by prosthodontists while orthodontists have noticed that widening of the maxillary arch considerably improves the appearance of the smile if cheek drape is significantly wider than the dental arch.

On smile, patients will show either their entire upper incisor or only a percentage of the incisor or gingival display. Therefore, the number of millimetres of crown display on smile is recorded, and this may include the entire crown or, in cases of incomplete incisor display on smile, the amount of incisor shown. In a youthful smile, 75–100% of maxillary central incisors should be positioned below an imaginary line drawn between the commisures this is known as Morley’s ratio (Fig. 5).

Perception of beauty is very subjective and varies from person to person depending on personal experience, social, cultural and racial interactions. For the same reasons, there can be differences of opinion regarding aesthetics between laypersons and dental specialists.

The aims of the present study were to: (1) evaluate and compare incisor display using Morley’s ratio in males and females (2) evaluate and compare buccal corridor widths in males and females (3) evaluate and compare smile arcs for consonance and non-consonance in males and females (4) evaluate and compare attractiveness of the posed smile in males and females by dental specialists and laypersons using VAS scale.

**MATERIAL AND METHODS**

A cross sectional study was done with a sample of 40 subjects including 20 males and 20 females within the age range of 17–25 years. The sample was taken from dental students at Swami Devi Dyal Dental College and Hospital, Panchkula, Haryana.

The following inclusion criteria:

- Clinically acceptable facial harmony and symmetry with a pleasing profile.
- Age group 17–25 years.
- Full complement of dentition except third molars with minimum arch length and tooth size discrepancies i.e. crowding and spacing ≤ 5 mm and with proper intercuspation.
- No active periodontal disease and no periodontal treatment except for routine oral prophylaxis.
- Normal upper lip length.
- No craniofacial anomalies.
- No canting of maxillary occlusal plane.
- No previous history of Orthodontic treatment.

Informed consent forms were signed and obtained from each subject before taking the frontal smiling photographs.

The subjects were photographed in the natural head position with the posed smile (Fig. 6A and B). Pictures were taken in the same environment with the same lighting conditions by using Nikon Digital SLR camera D5100 with DX format in JPEG image format. A tripod was used to fix the camera to one position for the standardization of the photographs and the pictures were taken in color. All the pictures were transferred to the computer software Microsoft Office Picture Manager version 7 for cropping. The pictures were cropped with the vertical limit from the nose tip to the soft tissue pogonion and transverse limit between perpendicular lines drawn down from the zygomatic prominence on each side (Fig. 6C).

![Fig. 1](A) Unposed smile, (B) Posed smile.
The 40 smile pictures were printed to a size of 4” × 6” and labeled F 1 to F 20 for females and M 1 to M 20 for males. The linear measurements for Morley’s ratio and buccal corridor widths were made on standardized printouts (4” × 6”) of the photographs for each patient. The inner and outer commissure widths on both sides were measured and the difference between these two lines was measured as the buccal corridor.

Two lines were drawn on the photograph to evaluate the smile arc, one connecting the incisal edges of the maxillary anteriors and the other through the upper border of the lower lip. Both the lines were checked for parallelism and the consonant and non-consonant smiles were determined separately for males and females.

To verify the repeatability of the measurements, 10 randomly selected subjects were photographed again with the same settings. These measurements were again calculated and compared with the initial photographs to check the reproducibility of the posed smile.

A panel of evaluators was selected to evaluate the attractiveness of the posed smile. The panel included 20 persons, 10 of whom were dental specialists (2 Orthodontists,
Is the posed smile contingent on sexual dimorphism? – a cross sectional study

Comparative analysis of male and female posed smiles revealed a significant difference in the attractiveness of the smile. Females were found to have a greater Morley’s ratio (90.5% ± 10.37) than males (78.50% ± 16.63) as seen in Table 2. The paired t-test for Morley’s ratio showed a statistically significant difference between the two sexes (Graph 1).

Table 3 shows the buccal corridor measurements of left and right sides for males and females. Pearson correlation values showed high correlation (P < 0.01) between left and right buccal corridor measurements in females while a moderate correlation (P < 0.05) was seen in males (Table 4 & Graph 2). When an independent t-test was performed, the right buccal corridor width was found to be significantly greater in females (P < 0.05) than in males while left side showed no such difference. According to paired t-test buccal corridor measurements showed no significant difference between the left and right side for either sex (Table 5 and Graph 3A, B).

RESULTS

Females were found to have a greater Morley’s ratio (90.5% ± 10.37) than males (78.50% ± 16.63) as seen in Table 2. The paired t-test for Morley’s ratio showed a statistically significant difference between the two sexes (Graph 1).

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Table 1: Visual analogue scale depicting attractiveness of smile.

<table>
<thead>
<tr>
<th>VAS score</th>
<th>Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;3</td>
<td>Very Good</td>
</tr>
<tr>
<td>3–4.9</td>
<td>Good</td>
</tr>
<tr>
<td>5–6.9</td>
<td>Average</td>
</tr>
<tr>
<td>&gt;7</td>
<td>Bad</td>
</tr>
</tbody>
</table>

Table 2: Morley’s ratio for males and females.

<table>
<thead>
<tr>
<th></th>
<th>Mean (mm)</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>78.50</td>
<td>16.63</td>
</tr>
<tr>
<td>Female</td>
<td>90.50</td>
<td>16.37</td>
</tr>
</tbody>
</table>

Table 4: Pearson correlation values for male and females.

<table>
<thead>
<tr>
<th>Right v/s Left</th>
<th>Pearson correlation</th>
<th>P value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male smiles</td>
<td>0.517</td>
<td>0.020</td>
<td>Significant at 0.05 level</td>
</tr>
<tr>
<td>Female smiles</td>
<td>0.596</td>
<td>0.006</td>
<td>Significant at 0.01 level</td>
</tr>
</tbody>
</table>

Table 5: Independent sample t-test.

<table>
<thead>
<tr>
<th>Male v/s Female</th>
<th>t value</th>
<th>Df</th>
<th>P value</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right side</td>
<td>2.089</td>
<td>38</td>
<td>0.043</td>
<td>Significant at 0.05 level</td>
</tr>
<tr>
<td>Left side</td>
<td>0.368</td>
<td>38</td>
<td>0.715</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

Table 6: Paired t-test to assess the difference between right and left sides.

<table>
<thead>
<tr>
<th>Right v/s Left</th>
<th>t value</th>
<th>df</th>
<th>P value</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male smiles</td>
<td>1.488</td>
<td>19</td>
<td>0.153</td>
<td>Not significant</td>
</tr>
<tr>
<td>Female smiles</td>
<td>1.891</td>
<td>19</td>
<td>0.074</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

Comparison of the male and female smiles for consonance showed no statistically significant difference as depicted in Graph 4. Out of 20 female subjects, 9 had a consonant smile arc while 11 had a non consonant smile arc. In 20 male subjects, 5 had a consonant smile arc while 15 subjects had a non consonant smile arc (Table 7).

The mean, median and the range for the VAS score given by dental specialists and laypersons for males and females is depicted in Table 8. The Spearman coefficient was found to be significant at 0.05 level.
rho correlation coefficient values in Table 9 show that there was no statistically significant correlation between male and female smiles when rated by both dental specialists and laypersons. But when male and female smiles were considered separately, a significant correlation was observed between dental specialists and laypersons. The classification of smiles showed no smile in the “bad” category for both the sexes while no smile was found in “very good” category for males. From a total of 20 female subjects, 4 were rated as “very good”, 10 as “good” and 6 as “average”. While in male subjects (20), 12 smiles were rated as “good” and 8 as “average”. Graph 5.

**DISCUSSION**

In our study, we aimed to evaluate different aspects of a posed smile in males and females, both objectively i.e. using the smile arc, Morley’s ratio and width of buccal corridors and according to the perception of both dental specialists as well as laypersons.

Females (90.5%) had a significantly greater Morley’s ratio on smiling as compared to males (78.5%). This

<table>
<thead>
<tr>
<th>Classification of Smile</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Good (&lt;3)</td>
<td>0</td>
<td>4 (20%)</td>
<td>4</td>
</tr>
<tr>
<td>Good (3–4.9)</td>
<td>12 (60%)</td>
<td>10 (50%)</td>
<td>22</td>
</tr>
<tr>
<td>Average (5–6.9)</td>
<td>8 (40%)</td>
<td>6 (30%)</td>
<td>14</td>
</tr>
<tr>
<td>Bad (&gt;7)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>20</td>
<td>40</td>
</tr>
</tbody>
</table>

$p = 0.107$; Not Significant.

**Graph 4.** Smile arc. **Graph 5.** VAS scores.
is contrary to the findings of study done by Weeden et al.\(^2\), who found that males exhibited greater amount of facial movements than females thus increasing the incisal display on smiling. The three female subjects who were rated as very good in the VAS scores and had consonant smile arcs, their Morley’s ratio was between 80 and 100%. While the five males with consonant smile arcs and VAS score rating as “good” had a Morley’s ratio between 75 and 90%. This is in accordance with the findings of Geld et al.\(^3\), who observed that smiles with teeth entirely displayed are perceived as more aesthetic.

The buccal corridor widths have been given importance in smile aesthetics in the recent years. Few reports show that buccal corridors have no effect on the aesthetic evaluation of smiles\(^6,10\). We evaluated the difference between buccal corridor widths on left and right side for both sexes and a positive correlation was observed between right and left buccal corridor widths in both sexes. Right buccal corridor widths were significantly greater in females than in males. This might be due to greater muscular activity to raise the upper lip as proposed by Peck et al.\(^1\), which might be more on the right side as compared to the left. The buccal corridor width is also affected by the width of the maxillary arch and the difference observed might be due to the same. In our study, it was seen that the female smile which had a consonant smile arc and VAS score rating as “very good” had a buccal corridor width ranging from 3 to 5.5 mm while the female smiles with a VAS rating of “average” had a buccal corridor width ranging from 3 to 6.5 mm. This suggests that the buccal corridor width does not affect the perception of attractiveness of a posed smile which is in conjunction with the previous studies\(^6,10\) and contrary to the findings of Parekh et al.\(^2\).

Consonant smile arcs are regarded more attractive than non consonant ones\(^3,13\). It was found in the present study that more female subjects (45%) had a consonant smile arc than males (25%) as was observed by Maulik and Nanda\(^4\). Among the 9 females with consonant smiles, 3 had a VAS score rating as “very good”, 5 as “good” and 1 as “average”. While in males all consonant smile had a VAS score rating of “good”. This is in agreement with the previous studies who have regarded consonant smiles as more aesthetic\(^3,13\). When treating cases, orthodontists should aim at maintaining consonant smile arcs or achieving the same by bracket positioning if there is a discrepancy.

For subjective evaluation of the smiles a panel of 20 people including 10 laypersons and 10 dental specialists (2 Orthodontists, 2 Periodontists, 2 Endodontists, 2 Oral Surgeons and 2 Prosthodontists) were chosen. The dental specialists from 5 different specialties were chosen to get a better overall view of aesthetic perception of a smile as regarded by a dentist. There was a high correlation between dental specialists and laypersons in rating the attractiveness of a smile when males and females were considered separately. This finding is contrary to previous studies\(^10,16–19\), while in agreement with studies of Flores-Mir et al.\(^12\) and Krishanan et al.\(^2\) who stated that the level of dental education has little impact on aesthetic perceptions of a person. Better VAS scores were observed in females by panelists of either sex which is contrary to the findings of Geron and Atalia\(^3\) who observed that female images were scored lower by both male and female evaluators.

The subjective perception of the panelists could have been affected by the gender one belonged to. So to remove this bias, we could have either considered male and female panelists separately to determine any difference which appears in evaluating smiles by sex or taken an equal number of male and female panelists in both laypersons and dental specialists as gender has an influence on a person’s perception\(^10\).

CONCLUSIONS

- Morley’s ratio (80-100%) and consonant smile arcs were regarded as more aesthetic.
- Buccal corridor widths on left and right sides in both sexes were correlated. Right buccal corridor widths in females were found to be significantly greater than in males.
- Considering the perception for males and females separately, a high correlation was found between the VAS scores given by dental specialists and laypersons.
- Dental education seems to have no effect on a person’s aesthetic perception.

REFERENCES