Facial Symmetry: An Illusion?


ABSTRACT

Objective: To investigate the laterality of the normal asymmetry of the human face, examining differences in laterality in relation to sex, and skeletal classification.

Materials and methods: A sample of 120 patients (60 males and 60 females; mean age, 15 years; range, 16-22 years) who had received orthodontic clinical examination at AME’s Dental College and Hospital were selected. Selection was made in such a way that following malocclusions with equal sexual distribution was possible from the patient database. Patients selected were classified into skeletal Class I (25 males and 25 females), Class II (25 males and 25 females) and Class III (10 males and 10 females) based on ANB angle. The number was predecided to be the same and also was based on the number of patients with following malocclusions reported to the department. Differences in length between distances from the points at which ear rods were inserted to the facial midline and the perpendicular distance from the soft-tissue menton to the facial midline were measured on a frontofacial photograph. Subjects with a discrepancy of more than three standard deviations of the measurement error were categorized as having left- or right-sided laterality.

Results: Of subjects with facial asymmetry, 74.1% had a wider right hemiface, and 51.6% of those with chin deviation had left-sided laterality. These tendencies were independent of sex or skeletal jaw relationships.

Conclusion: These results suggest that laterality in the normal asymmetry of the face, which is consistently found in humans, is likely to be a hereditary rather than an acquired trait.

Keywords: Laterality, Hemiface, Jaw deviation, Human.


INTRODUCTION

Stedman’s medical dictionary defines symmetry as ‘Equality or correspondence in form of parts distributed around a center or an axis, at the two extreme or poles, or on the two opposite sides of the body.’ Clinically, symmetry means balance while significant asymmetry means imbalance.

Numerous factors such as cleft lip, hemifacial microsomia and childhood fracture of the jaw have been reported to be associated with facial asymmetry. These conditions often result in severe and pathologic asymmetry of the face. On the other hand, minor nonpathologic facial asymmetry which is defined as the difference in size between the left and right hemifaces or normal asymmetry, is relatively common.

Most of the studies of normal asymmetry have reported that the right hemiface is wider than the left. However, some reports have documented no significant difference between right and left hemiface size or have found left hemiface to be wider. Similarly, a few studies have reported on the laterality of chin deviation, a subject that remains controversial. A recent cephalometric study reported left sided deviation of the menton from the midline in 60% who exhibited facial asymmetry. In contrast, other studies have reported no such trait in patients with skeletal Class III and long faces.

The purpose of this study were: (1) to investigate the laterality of normal asymmetry of the human face in Raichur subjects reported to the department, (2) to investigate differences in laterality related to sex and skeletal classification.

MATERIALS AND METHODS

A sample of 120 patients (60 males and 60 females; mean age, 15 years; range, 16-22 years) who had received orthodontic clinical examination at AME’s Dental College and Hospital were selected. The selection was made in such a way that following malocclusions with equal distribution was possible from the patient database. Patients selected were classified into skeletal Class I (25 males and 25 females), Class II (25 males and 25 females) and Class III (10 males and 10 females) based on ANB angle. The number of Class III patients were less as the frequency of Class III cases reported to the department were less.

Patient with congenital craniofacial anomalies or severe facial deformities including cleft lip and/or palate, severe malpositioning of the orbits or ears, and functional shift of the mandible were excluded.

Conventional facial photographs were taken with the head fixed using ear rods and the Frankfort horizontal plane parallel...
with the ground in maximum intercuspation. An SLR camera (canon 1000D) and telescopic lens were set perpendicular to a line connecting the bilateral rods calibrated using a grid sheet within errors of less than 0.001 mm. The recording distance between the camera and the patient was 100 cm. Photos that did not depict the patient looking straight at the camera or those in which hair obscured the outline of the face or the pupils were excluded. Each photograph was analyzed with software program (CorelDRAW 10.0).

Points er and points erl were defined as points on the patients right and left sides where a line connecting the centers of the ear rods intersects the outer contour of the face. The facial midline was defined as the perpendicular bisector of the line between the centers of the right and left pupil. The differences in the distances between er to the facial midline and for err to the facial midline were defined as dFW. Soft tissue menton, (me) was defined as the lowest point of the outer contour of the face on the standard facial photographs. The horizontal distance between me and the facial midline was defined as dME.

To estimate the measurement error, 20 subjects were selected randomly for a pilot study and each measurement was done three times. Standard deviations of measurement errors were 0.2 mm for dFW and 0.25 mm for dME. A value of dFW within 0 mm ± 2 SD of the measurement error was defined as having no laterality. A value of dFW smaller than 0 – 2 SD was taken to indicate a wider right hemiface whereas a dFW exceeding 0 +2 SD was considered to represent wider left hemiface. In a similar manner, if dME fell within 0 mm ± 2 SD of the measurement error, the chin was considered to have no deviation. A dME of less than zero – 2 SD was defined as left-sided deviation, whereas a dME exceeding zero +2SD was defined as right-sided deviation. Patients were categorized by sex (male or female) and skeletal pattern (skeletal Class I, II, III). Skeletal classifications were made based on the ANB angle as described in previous reports.16

STATISTICAL ANALYSES
Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients, Chi-square/Fisher exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

+ Suggestive significance (p-value: 0.05 < p < 0.10)
* Moderately significant (p-value: 0.01 < p < 0.05)
** Strongly significant (p-value : p ≤ 0.01)

RESULTS
Table 1, Figures 2 and 3 shows the proportions of subjects with greater left or right hemiface dimensions well as no laterality divided by sex and skeletal pattern. The proportion of subjects with wider right hemiface was significantly higher than those with wider left hemiface for each category (p < 0.05). The proportion of subjects with right side wider was higher in Class II and III groups in males and Class I and III group in females.

Table 2, Figures 4 and 5 displays the proportions of subjects who showed left or right-sided deviations from facial midline or no deviation. For each category, the proportions of subjects who showed left-sided deviation was significantly greater than the proportion with right-sided deviation. (p < 0.05). The proportion of subjects who showed left-sided deviation was greater in Class I and III groups in males whereas in females the proportion was similar in Class I and II group but higher in Class III group.

Table 1: Comparison of frequency of dFW (L-R) in three skeletal class and gender

<table>
<thead>
<tr>
<th></th>
<th>Class I</th>
<th>Class II</th>
<th>Class III</th>
<th>p-value</th>
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<tbody>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Right sided (–)</td>
<td>15 (60.0%)</td>
<td>17 (68.0%)</td>
<td>10 (100.0%)</td>
<td>0.035*</td>
</tr>
<tr>
<td>• Left sided (+)</td>
<td>6 (24.0%)</td>
<td>8 (32.0%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>• No change</td>
<td>4 (16.0%)</td>
<td>0</td>
<td>0</td>
<td></td>
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</table>

Female

<table>
<thead>
<tr>
<th></th>
<th>Class I</th>
<th>Class II</th>
<th>Class III</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Right sided (–)</td>
<td>21 (84.0%)</td>
<td>16 (64.0%)</td>
<td>10 (100.0%)</td>
<td>0.016*</td>
</tr>
<tr>
<td>• Left sided (+)</td>
<td>2 (8.0%)</td>
<td>9 (36.0%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>• No change</td>
<td>2 (8.0%)</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

*Statistically significant

Fig. 1: Illustration of reference points and the linear measurements used on facial frontal photograph. err: ear rod right side; erl: ear rod left side; me: menton; msp: midsagittal plane (bisecting the interpupillary line)

Fig. 2: Frequency of dFW (L-R) in three skeletal Class in males
DISCUSSION

The study of orthodontics is indissolubly connected with that of art as related to the human face. Therefore, the subject of facial esthetics is of paramount importance to orthodontics. Facial esthetics in terms of symmetry and balance is referred to the state of facial equilibrium, the correspondence in size form and arrangement of facial features on the opposite sides of the median sagittal plane. Various methods have been used to investigate the laterality in human face involving frontal facial photographs, posterior-anterior cephalograms and stereophotogrammetry. The key to evaluating facial asymmetry with any of these methods is defining the criteria for determining the facial midline. Because there is no absolute facial midline, we employed the centers of the pupils of the eyes as landmarks for defining the facial midline, as well as defined the area of the head forward of the ears as the face.

Previous reports have suggested that facial asymmetry is likely to exhibit laterality. The present study examined facial laterality from two perspectives: (1) which side of the hemiface is most likely to be wider and (2) to which side does the chin tend to deviate. The results indicate that 74.1% of subjects had a wider right hemiface and concomitantly 51.6% of subjects showed chin deviation with left-sided laterality. The proportion of subjects with wider right hemiface was greater in Class II and III group in males and Class I and III group in females. Chin deviation with left sided laterality was greater in Class III group.

These findings suggest that, overall the proportions of subjects with jaw deviation is greater in Class III group as these patients exhibit greater growth and are also more likely to be affected by postnatal environmental influences because of relatively longer jaw growth period. Previous studies have discussed the possible causes of facial laterality. Most have concluded that environmental influences were the most likely cause. Habitual chewing on one side has been reported to lead to increased skeletal development on the ipsilateral side. Others have also discussed the possibility that such laterality is simply a response of functional adaptation to asymmetrical masticatory activity.

On the other hand, other studies that have investigated facial asymmetry have emphasized the innate functional and structural differences between the cerebral hemispheres, suggesting that it would not be surprising if the normal asymmetry of the human face primarily originated from brain and skull base asymmetry.

According to a recent report, lateral displacement of the cephalometric menton toward the left side of the face is found
more frequently than right-sided deviation. The study also documented, however, that subjects who had received chin cup treatment or had exhibited TMJ symptoms and/or reported a history of maxillofacial injury showed a higher proportion of right-sided chin deviation at menton when compared with those who had not experienced those factors. It was, therefore, suggested that these postnatal factors are not the causes of directional uniqueness in menton deviation.

The results of a recent study, however, suggest that the proportion of subjects with right-sided laterality decreases with age while the proportion of those with left-sided laterality increases. There is no racial or ethnic differences in right-sided laterality of the face.

It can be speculated that the laterality in normal asymmetry consistently found in human faces may likely be induced by prenatal rather than postnatal factors, such as a functional bias induced by facedness or lateral preference in mastication. Finally, the results of the present study may help to explain why photographic frontal views of the human face that are artificially manipulated to reflect complete symmetry appear so strange to the viewer’s eyes. The perfectly symmetric face differs sharply from the normal symmetric face that is so familiar to us and thus may seem unnatural.

CONCLUSION

The results showed that 74.1% of subjects with facial asymmetry had a wider right hemiface and that 51.6% of the subjects with chin deviation showed left-sided laterality. Laterality in the normal asymmetry of the face is consistently found in orthodontic patients.

The right-sided dominance of the face was independent of sex and skeletal jaw relationships.

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REFERENCES