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ABSTRACT

Introduction: As the demand for facial esthetics has increased, more patients nowadays complain of the development or the progression of facial asymmetry. The purpose of present study is to evaluate the facial asymmetry with the help of facial photographs and its validity and authenticity to be used as a valid clinical tool for clinical practice.

Materials and methods: Total 30 adults were selected in the age range of 18 to 25 years with facial asymmetry. Barium points were marked on right and left medial and lateral canthus of eyes. Frontal view photographs and posteroanterior view radiographs were taken of all individuals selected. With Visual Basic Studio 2005 software, photographs and radiographs were converted in OLE (server). The obtained images were digitized by using AutoCAD software. The right and left halves were then compared on photographs and radiographs in terms of area, perimeter, compactness and moment ratio. The data derived was subjected to Spearman rank correlation statistical analysis. The level of significance was set to p < 0.05.

Result: On correlation of ratios between photographic and radiographic values, significant correlation was observed in terms of area, compactness and moment ratio whereas perimeter showed nonsignificant relationship.

Conclusion: Photographs can be used as an effective diagnostic tool as comparable to radiographs for assessing facial asymmetry.

Keywords: Esthetics, Asymmetry, Photographs, Radiographs.

INTRODUCTION

The study of orthodontics is indissolubly connected with that of art related to the human face; therefore, the subject of facial esthetics is of paramount importance to an orthodontist. Facial esthetics means symmetry and balance; it is the state of facial equilibrium, the correspondence in size, form and arrangement of facial features on the opposite side of the medial sagittal plane. Symmetry may be defined as ‘equality or correspondence in the form of parts distributed around a center or an axis, at the two extremes or poles or on the two opposite sides of the body’.

As the demand for facial esthetics has increased, more patients are nowadays complain of the development or the progression of facial asymmetry, moreover patients with no obvious facial and dental asymmetries have been found to exhibit skeletal size difference when left and right sides of the face are compared.

Facial asymmetry may be associated with the mandibular displacement and/or abnormal path of closure due to occlusal prematurity. Because a misdiagnosis of facial asymmetry can result in the wrong treatment for a patient, accurate evaluation of facial asymmetry is crucial in orthodontic practice.

Marmay Y et al suggested using the perpendicular bisector of the transverse distance between the foramina spinosum as a reliable cranial midline for submentovertex radiographs. Orthopantomogram (OPG) can be used to measure the asymmetry of the face but in both these techniques there is a problem of anatomic landmark identification because of bony superimposition.

Zhang X et al studied correlation between cephalometric and facial photographic measurements. Although statistically significant, the correlations between analogous photographic and cephalometric measures suggested that these modalities...
measure different aspects of facial morphology and cannot be used interchangeably.

Posteroanterior cephalometry is the most commonly used means of measuring facial asymmetry. The existence of so many approaches indicates that for everyday clinical purpose, none is ideal. Problems of landmark identification because of bony superimposition, and the reliability of measurements taken from posteroanterior cephalometric radiographs are often questionable.

Three-dimensional imaging techniques, such as stereo photogrammetry, laser scanning or optical scanning and 3D analysis including pitch (up-down deviation around anterior-posterior axis), roll (up-down deviation around transverse axis) and yaw (right-left deviation around vertical axis) description involves costly equipment and are currently available only to a few clinicians working in the specialized centers.

Hence, there is a need of a valid and reproducible method for quantifying facial asymmetry which can be of clinical value in day to day orthodontic practice. This will also help to evaluate changes in facial asymmetry, either by growth, treatment or relapse after treatment. The purpose of present study is to evaluate the facial asymmetry with the help of facial photographs and its validity and authenticity to be used as a valid clinical tool for clinical practice.

MATERIALS AND METHODS

The present study was carried out in the Department of Orthodontics and Dentofacial Orthopedics, Sharad Pawar Dental College, Datta Meghe Institute of Medical Sciences (Deemed University), Wardha, Maharashtra.

On approval from the ethical committee of Datta Meghe Institute of Medical Sciences (Deemed University), total 30 individuals were selected from the Outpatient Department of Orthodontics and Dentofacial Orthopedics, Sharad Pawar Dental College and Hospital, Sawangi (Meghe), Wardha, Maharashtra, India.

Adults in the age range of 18 to 25 years with facial asymmetry on clinical examination were selected with no history of trauma, bone disease, muscle dystrophy, congenital abnormalities, cyst, tumors or any other pathological conditions and they had no history of orthodontic treatment.

Barium points were marked on right and left medial and lateral canthus of eyes (Fig. 1) so that the baseline can be kept same in photographs as well as radiographs. As barium points are radiopaque in nature, they can be distinguished easily on the radiographs. All the individuals were asked to close lightly on their back teeth to avoid expressive activity. Earrings and eye glasses were removed and long hairs were tied back.

Frontal view photographs (Fig. 1) and posteroanterior view radiographs (Fig. 2) were taken of all individuals selected. The photographic method is a quantitative method that is not only valid and reproducible but also noninvasive, convenient to use, low cost, less technique sensitive and takes soft tissue morphology into consideration. Whereas the posteroanterior cephalogram is a valuable tool in the study of right and left structures since they are located at relatively equal distances from the film and X-ray source. As a result, the effects of unequal enlargement by the diverging rays are minimized and the distortion is reduced. Comparison between sides is therefore more accurate since the midline of the face and dentition can be recorded and evaluated. PA view cephalogram was taken with teeth in centric occlusion.

Frontal view photographs were taken using Nikon D70 SLR camera under standardized conditions, i.e.

- Frankfort horizontal plane of the patient was kept parallel to the floor using custom-made fluid level device
- Focal length of the lens was kept constant at 135 mm for all the individuals
- Distance from camera lens to patient was 160 cm which was kept constant by placing a scale on the floor and two threads were dropped perpendicular to the floor of which one was dropped from the nose and the other from the outer part of the lens of the camera
- Shutter speed was 500
- Aperture (F stop) 11
- Two main Bowen Esprit lights with diffuse reflectors were used as focus lights which were 6 feet high and adjusted at 45° angle to the patient to avoid shadows
- Bizygomatic width of each patient was measured with spreading caliper so that the images can be kept of original size when it is transferred to the computer.

The posteroanterior radiographs were scanned with Epson Perfection V-700 photo (model J221A, Dual Lens System, Digital Ice Technology) negative scanner in 1:1 ratio.

The obtained photographs and radiographs were transferred to computer and were cropped in 6 × 4 inches with a resolution of 300 pixel/inch by Adobe Photoshop 7. Then with Visual Basic Studio 2005 software, photographs (Fig. 3) and radiographs (Fig. 4) were converted in OLE (server). The obtained images were digitized by using AutoCAD software.

Following landmarks were marked:

- Right and left outer canthus of eyes
- Right and left inner canthus of eyes
Assessment and Comparison of Facial Asymmetry by Photographic and Radiographic Measurements

The right and left halves were then compared on photographs and radiographs in terms of area, perimeter, compactness and moment ratio.

For three parameters, namely area, perimeter and compactness, the ratio representing ideal symmetry is 1.00. Accordingly, the ratio increases from 1.00 (right side dominant) or decreases from 1.00 (left side dominant) representing the level of asymmetry. For moment ratio, the deviations are zero-based.

The data derived was subjected to Spearman rank correlation statistical analysis. The level of significance was set to \( p < 0.05 \).

**RESULT**

The values in Tables 1A and B showed both the methods viz photographic and radiographic, are suggestive of similar type of results. The mean value of area, perimeter and compactness if increases in radiographs, it also increases in photographs.

There was no significant difference found in the mean values of ratios, when right and left of photographs and radiographs were compared for area, perimeter and compactness (Table 1A). On correlation of ratios between photographic and radiographic values (Table 1B) significant correlation of area, compactness and moment ratio was observed whereas perimeter shows nonsignificant relationship. Hence, photographs can be used as an effective diagnostic tool as comparable to radiographs for assessing facial asymmetry.

**DISCUSSION**

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

Asymmetry is the degree of imbalance or deviation in both qualitative and quantitative features in structure or relationship and both. Clinical facial asymmetry in the craniofacial complex ranges from the barely detectable to gross discrepancies between the right and left half of the face.

### Tables 1A and B: Spearman rank correlation of ratios measured from photographs and PA cephalograms; (A) Descriptive statistics

<table>
<thead>
<tr>
<th></th>
<th>Area</th>
<th>Perimeter</th>
<th>Compactness</th>
<th>Moment ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right side</td>
<td>20.17 ± 2.98</td>
<td>20.86 ± 1.56</td>
<td>22.22 ± 5.15</td>
<td>0.83 ± 0.05</td>
</tr>
<tr>
<td>Left side</td>
<td>20.22 ± 2.77</td>
<td>19.12 ± 2.72</td>
<td>18.41 ± 4.88</td>
<td>–</td>
</tr>
</tbody>
</table>

| Right side | 18.93 ± 2.98 | 18.41 ± 1.89 | 18.70 ± 5.70 | 0.72 ± 0.09 |
| Left side  | 19.09 ± 2.77 | 16.87 ± 2.34 | 15.21 ± 3.73 | –            |

### Photo against PA

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Area</th>
<th>Perimeter</th>
<th>Compactness</th>
<th>Moment ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \rho ) (rho)</td>
<td>0.88</td>
<td>0.46</td>
<td>0.52</td>
<td>0.365</td>
</tr>
<tr>
<td>p-value</td>
<td>0.000 S, ( p &lt; 0.05 )</td>
<td>0.060 NS, ( p &gt; 0.05 )</td>
<td>0.003 S, ( p &lt; 0.05 )</td>
<td>0.047 S, ( p &lt; 0.05 )</td>
</tr>
</tbody>
</table>

NS: Not Significant; S: Significant
Facial asymmetry being a common phenomenon, was probably first observed by the artists of early Greek statutory who recorded what they found in nature—normal facial asymmetry. Asymmetry in craniofacial areas can be recognized as differences in the size or relationship of the two sides of the face. This may be the result of discrepancies either in the form of individual bones or a malposition of one or more bones in the craniofacial complex.\(^9\)

The asymmetry may also be limited to the overlying soft tissues. In diagnosis of facial and dental asymmetries, a thorough clinical examination and radiographic examination are necessary to determine the extent of the soft tissue, skeletal, dental and functional asymmetry.

Diagnosis of asymmetries in orthodontics is important and must be differentially diagnosed as being either the result of a skeletal asymmetry, asymmetry within the dental arches, discrepancies between centric occlusion and centric relation, or a combination.

A detailed study of the various diagnostic records obtained on the patient is necessary in order to determine the cause, location and extent of the asymmetry.

Edler R et al\(^10\) conducted a study to compare mandibular asymmetry with posteroanterior cephalometric and photographic measurements. The results of present study were similar with that of Edler R et al.\(^10\) Area, compactness and moment ratio showed significant correlation whereas perimeter ratio showed nonsignificant correlation between photographs and radiographs.

Raymond E et al\(^11\) did clinical and computerized assessment of mandibular asymmetry by eight experienced clinician to evaluate new computerized system. They found that area, compactness and center of area are potentially useful measures of quantifying asymmetry. Perimeter ratio was not found to be useful indicator of whether treatment was required. These findings correlate with the present study.

**CONCLUSION**

As there is a significant correlation between the photographs and radiographs in terms of area, compactness and moment ratio, photography can be used as an important diagnostic tool to measure facial asymmetry, to establish a proper orthodontic treatment plan and in long-term monitoring of patients after orthodontic or orthognathic correction. Perimeter ratio showed statistically nonsignificant correlation between the photographs and posteroanterior radiographs.

There are certain limitations to the present study such as,
- The perimeter type of measurement is more sensitive to minor errors in outline digitization. For measurement of perimeter greater accuracy is required so that there will be fewer chances for errors
- The photographic setup used in this study is complex and further work, using a simple approach is required.

**REFERENCES**