Anthropometry of the Face in Lateral Facial Dysplasia: The Bilateral Form

R. BRUCE ROSS, D.D.S., Dip. in Ortho., M.Sc., F.R.C.D.(C),
JEANETTE S. JAMES, H.N.C.
Toronto, Ontario, Canada

The morphology of the head, face, and ears was studied in 26 patients with bilateral lateral facial dysplasia in The Hospital for Sick Children, Toronto, using anthropometric and cephalometric methods. The anthropometric data of the maxilla and mandible were compared to the cephalometric findings.

The study showed that, in the majority of the patients, one side of the face was more damaged than the other and was associated with a high frequency of defects in all areas of the face. The microtic ear was not necessarily part of this syndrome. The anthropometry proved to be a valuable supplement to the x-ray cephalometry assessment of the malformed face.

The bilateral form of lateral facial dysplasia (LFD) is synonymous with bilateral facial microsomia (Converse, et al., 1974; Ross, 1975). This infrequent syndrome has received little attention from morphologists. Most of the published data were based on visual evaluation of the clinical condition (Dupertuis and Musgrave, 1959; Lindsay, 1974; Meurman, 1957) while only a few (Converse, et al., 1974; Grabb, 1965; Ross, 1975) have analyzed the syndrome using cephalometric roentgenographs. Studies have not been done of the surface structures and soft tissues of the congenitally damaged face, and these are not detectable on roentgenographs.

This study assessed the characteristics of the head and face of patients with bilateral LFD by means of physical anthropometric techniques and compared the findings with radiographic studies of the same patients.

Materials and methods

The study group consisted of 26 Caucasian patients, 9 males and 17 females, between five and 18 years of age, all diagnosed as bilateral LFD by a research team* at The Hospital for Sick Children, Toronto (Ross, 1975).

Dr. Farkas is an Assistant Professor, Department of Surgery, University of Toronto, Toronto, Ontario, Canada.
Dr. Ross is an Assistant Professor, Faculty of Dentistry, University of Toronto. Both doctors are on the Staff of The Hospital for Sick Children.
Jeanette S. James is in the Dept. of Surgical Research, Plastic Surgery Research Laboratory, The Hospital for Sick Children, Toronto, Ontario, Canada.

Thirty-three surface and 16 qualitative measurements of each patient were carried out by one person (L. G. Farkas) as previously described (Farkas and Lindsay, 1971, 1972, 1973; Lindsay and Farkas, 1972; Martin and Saller, 1957; Weiner and Louril, 1969). Normative data from West German boys and girls of corresponding age were used for control values (Hajniš, 1974). Statistical analysis of the material was completed using standard methods. Measurements differing by ±2 SD from the normal values were designated as “abnormally” short or long.

A large number of skeletal cephalometric measurements and evaluations previously gathered on these patients (R. B. Ross) were used to assess four characteristics: (1) degree of mandibular retrusion; (2) degree of mandibular asymmetry; (3) degree of maxillary retrusion; and (4) temporomandibular joint abnormality.

For purposes of this study these characteristics were noted as moderate/severe or normal/mild.

**Classification**

The clinical characteristics in bilateral LFD are diverse. In spite of the fact that both sides of the face are involved, the extent of the defect varies in intensity. These differences served as the criterion for classification, and the patients were divided into three groups: right bilateral (13 patients) or left bilateral (seven patients), both groups with a prevalence of defects on one side of the face, and simple bilateral (six patients) in whom the defects were almost equally distributed on both sides of the face (Figure 1).

*FIGURE 1. Seven-year old girl with bilateral lateral facial dysplasia. The left side is more severely involved with microtia, orbital displacement, mandibular hypoplasia and VII N dysfunction. The right ear and mandibular condyle are also involved. Cleft palate and vertebral anomalies are present. This patient is classified as a bilateral left condition.*
Results

NEUROCRANIUM

*Abnormal Measurements (Figure 2).* The only frequent sign found was a shortening of the skull base width (t-t), and it occurred in nine patients. A short skull length (g-op) or skull width (eu-eu) was rare.

FACE

*Abnormal Vertical Measurements (Figure 2).* Height of the upper face (n-sto) was long in six patients. Height of the lower third of the face (sto-gn) was short in four patients, and one patient had a long face (n-gn).

*Abnormal Horizontal Measurements (Figure 3).* All abnormal measurements were short: the bizygomatic diameter (zy-zy) in 13 patients, the tragion-subnasale half-arc (t-sn) in 23 patients, and the tragion-gnathion half-arc (t-gn) in 22 patients. The bitragion subnasale arc generally
corresponds to the maxillary area while the bitragion-gnathion arc covers the mandible and temporo-mandibular joint region.

Both half-arcs of the maxilla and both half-arcs of the mandible were short in the faces of 12 patients. In five patients the bilaterally short mandible was combined with a short maxillary half-arc. Unilaterally short half-arcs of the maxilla and mandible on the same side of the face were seen in five patients. Bilaterally normal half-arc measurements, both maxillary and mandibular regions, were found in three cases. In the remaining patient, the only deficient measurement was one short maxillary half-arc (Figure 4).

Asymmetry in the Middle and Lower Third of the Face. Asymmetry between normal half-arcs of either the maxillary or mandibular region was slightly more than three mm as is frequently seen in the normal population. When both halves of the maxillary or mandibular arc were short, the difference increased to an average of 10 mm in the maxilla and 15 mm in the mandible. The asymmetry reached the striking value of 21 mm in the maxilla and 40 mm in the mandible when one half-arc was short and the other in normal range.
None of the patients with bilateral LFD demonstrated symmetrical halves in the mandibular arc.

Cephalometrically, there were nine patients with mild asymmetry of the mandible and 14 with moderate or severe asymmetry. There was a close association between the degree of asymmetry and the degree of mandibular retrusion and temporo-mandibular joint abnormality (Table 1). Maxillary retrusion was associated with mandibular asymmetry but the relationship was less direct.

Relationship Between Horizontal and Vertical Measurements of the Neurocranium and the Face. A narrow skull base width (t-t) or a narrow face (zy-zy) or both were invariably followed by a shortening of the maxillary (t-sn) and mandibular (t-gn) half-arcs.

Vertical lengthening of the upper face (n-sto) was constantly associated with normal height of the lower third of the face (sto-gn).

There were three patients out of four in whom the lower third of the face was short both in the vertical (sto-gn) and the horizontal (t-gn-t) direction.

Orbits

Abnormal Measurements (Figure 3). The interocular diameter (en-en) was long (with a maximum of 42 mm) in 15 patients, and the biocular diameter (ex-ex) was short in two patients and long in one patient. The long biocular diameter was found with a long interocular diameter.

Asymmetries. In five patients there was a two to four mm difference between the right and left endocanthion to facial midline distance, and
TABLE 1. Relation between mandibular asymmetry and other jaw characteristics

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<thead>
<tr>
<th></th>
<th>normal or mild mandibular asymmetry (n = 9)</th>
<th>moderate or severe mandibular asymmetry (n = 14)</th>
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<tbody>
<tr>
<td>Maxillary Retrusion*</td>
<td>Normal/Mild 7</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Moderate/Severe 1</td>
<td>6</td>
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<tr>
<td>Mandibular Retrusion**</td>
<td>Normal/Mild 7</td>
<td>1</td>
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<tr>
<td></td>
<td>Moderate/Severe 2</td>
<td>12</td>
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<tr>
<td>Temporo-Mandibular Joint Abnormality***</td>
<td>Normal/Mild 6</td>
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<td>Moderate/Severe 2</td>
<td>14</td>
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* Data not available for one patient.
** Data not available for two patients.
*** Data not available for one patient.

Palpebral fissures differing by two to three mm in length were seen in six patients.

Epicanthi were registered in 15 out of 23 patients over six years of age (65.2%), significantly more often than in controls which were 12 out of 100 (12%). Only 25 per cent of the wide interocular diameters were associated with epicanthi. Mongoloid eye fissure slants were found in three patients. In another three patients the upper eyelid was affected by congenital ptosis or coloboma or both. A defective lower eyelid (lidodermoid) was noted in two patients.

Only one out of 26 patients was free of any metric or qualitative defects of the orbit.

**Nose**

*Abnormal Measurements (Figure 5).* The nose was long (n-sn) in seven patients, and the nasal bridge or columella or both were deviated by 2°–10° in six patients. In four patients the nose was narrow in the bi-alar diameter (al-al).

The patients with long noses were found to have prolonged upper faces (n-sto). There was a direct relationship between the degree of the nasal deviation and the extent of the facial asymmetry in the middle third of the face. The side of the deviation was usually associated with columella deviation, alar base dislocation, and nasal floor asymmetry. A short bi-alar diameter was always associated with bilaterally short half-arcs of the maxillary region.

*Asymmetries.* The most frequent signs were found in 11 patients and consisted of asymmetrical nasal floor widths with a maximum difference of five mm and differing columella lengths with a maximum of three mm. Dislocation of the alar base in the horizontal plane with maximum difference of four mm between the levels was seen in eight patients. In one-third this was associated with ala hypoplasia. The dislocation of the alar base in the sagittal plane was noted in five patients. All alar base defects were found on the side of the more deficient maxillary half-arc.
Disfigurements of the soft nose, such as flattening of the nasal ala (nine patients) or nasal tip (three patients) were caused either by nasal ala hypoplasia or by dislocation of the alar base downwards or laterally, or both. The ala hypoplasia was of slight degree and did not affect the width of the nose (al-al).

The most sensitive indicator of the soft nose deformation was the nostrils, and they were found to be asymmetrical in type and size in more than half of the patients. “Normal” noses were found in only four of 26 patients with bilateral LFD.

**Upper Lip and Mouth**

*Abnormal Measurements (Figure 5).* The medial vertical upper lip length (sn-sto) was long in four patients who had prolonged upper faces. The labial fissure (ch-ch) was short in three patients, two of whom had repaired macrostomia.

*Asymmetries.* A difference (with a maximum of four mm) between the two lateral vertical heights of the upper lip was found in 18 patients and was caused by nasal alar base dislocation, nasal ala hypoplasia, vermilion irregularities of the upper lip, and oblique slanting of the labial fissure.
The halves of the labial fissure, with no sign of lateral cleft, were asymmetrical by two to five mm in 10 patients. The longer portion of the labial fissure was found on the side of the greater facial damage, and the mouth commissure was usually higher on this side.

There were six unilateral and one bilateral macrostomias. The former were always located on the side of the greater damage to the face, which was severely asymmetrical. The bilateral was seen in a slightly asymmetrical face. All patients who had repaired commissural clefts had asymmetrical labial fissure halves, but in three patients the upwards or downwards direction of the commissure made the labial fissure oblique.

Twenty-two out of 26 patients had at least one of the above quantitative and/or qualitative defects.

EARS

Microtic ears were found in 18 patients. Rudimentary aplastic ears (four bilateral and six unilateral) were found in 10 patients; six had ear hypoplasia (two bilateral and four unilateral); and two patients exhibited an ear rudiment on one side and a hypoplastic ear on the other side. All microtias were low set. The ears of eight patients classified as bilateral LFD were of normal size on both sides. These auricles, however, were not free of defects. All exhibited differences between the levels of the ears (seven-17 mm). Six patients had ears of different sizes, and two patients showed different inclination of the longitudinal axis. These ears also varied in the shape or width of the helix or in the development of the earlobes.

The normal sized ears in the ten patients whose other ear was microtic demonstrated similar aberrations to those listed above.

Microtia in two patients was combined with normal auditory meati while a narrow meatus was found in three patients with bilaterally normal sized ears.

The radiological examination of the temporal bone was positive in seven out of eight patients with normal sized ears bilaterally. Radiological findings revealed that the mastoid and the antrum were hypoplastic on one side (seven patients), that there was hypoplasia in the middle ear cavity (two patients) and dysplasia of the malleus and incus (one patient). Mastoid hypoplasia, antrum hypoplasia, or both was also seen on the side of the normal sized ear in three out of 10 patients in whom the ear on the opposite side was microtic (Harwood-Nash, In Manuscript).

Preauricular tags were seen bilaterally in 16 patients and unilaterally in eight patients. These were located in front of 24 normal ears and 16 microtic ears.

None of the patients was found without one of the above listed metric and/or qualitative defects of the ears.

Difference Between Simple Bilateral and Right (Left) Bilateral Forms. The average difference in the maxillary half-arcs was 4.5
mm in the simple bilateral LFD and 17.6 mm in the right (left) LFD. The average difference between the mandibular half-arcs was 5.8 mm in the simple bilateral LFD and 22.1 mm in the right (left) bilateral LFD.

The frequency of severe (greater than 10 mm) maxillary or mandibular asymmetries or both was greater using surface measurements in right (left) bilateral LFD (55%) than in simple bilateral LFD (16.6%).

Cephalometric analysis provided less marked differences in asymmetry. Sixty-five per cent of the right/left bilateral patients and 50 per cent of the simple bilateral patients exhibited moderate to severe asymmetry of the mandible (Table 2). Mandibular retrusion and temporo-mandibular joint abnormality were more common in the right/left bilaterals, while maxillary retrusion was more common in simple bilaterals.

Facial defects such as deviation of the nasal bridge and columella, alar base impression, flat nasal tip, asymmetry in the halves of labial fissure, and vermilion defects were never found in the simple form of bilateral LFD, and other defects such as those of the orbits, nose and lips were found in lesser frequency.

The developmental defects of the ears were similar in degree and frequency in the various forms of bilateral LFD.

**Discussion and conclusions**

There was a tendency to shortening of the horizontal measurements of the face while the vertical measurements of the face exhibited prolongation. Abnormally short mandibular or maxillary arc or both were observed in 88.5 per cent of the patients. Generally, no direct relationship was observed between the degree of microtia and the extent of facial defect.

Preauricular tags were typical signs in LFD patients and can be qualified as a minor manifestation of the first branchial arch defect (Lindsay, 1974; Pruzansky, 1973; Smith, 1970). They were found in front of 92 per cent of normal sized ears and in 98 per cent of microtic ears.

Macrostomias, mostly unilateral, were located on the more damaged side of the face. Asymmetry between the halves of the labial fissure of non-cleft origin, a relatively frequent sign in LFD, could be the result of the unbalanced tension of the facial muscles.

The greater damage in the mandibular region combined with the

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<th>TABLE 2. Incidence of jaw abnormalities in patients with simple bilateral and right/left bilateral involvement</th>
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<td><strong>simple</strong></td>
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<td><strong>bilateral</strong></td>
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<tr>
<td>Maxillary retrusion—moderate/severe</td>
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<td>Mandibular retrusion—moderate/severe</td>
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<td>Mandibular asymmetry—moderate/severe</td>
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<td>Temporo-mandibular joint abnormality—moderate/severe</td>
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multiple facial defects made the clinical picture of the right (left) bilateral LFD appear more severe than the simple bilateral LFD.

Our observations can be summarized in the following points:

1. Various types of microtic ears were seen in 69 per cent of the cases.
2. A balanced distribution of defects on both sides of the face was seen in one-third of the patients. In two-thirds of the patients the face was markedly more damaged on one side.
3. Normal sized ears in LFD patients had preauricular tags and were not free of other defects.
4. The syndrome exhibited a high involvement of all parts of the face.
5. The clinical appearance did not necessarily accurately reflect the underlying skeletal defect.

Although the division of lateral facial dysplasia to unilateral (Farkas and James, In Press) and bilateral forms seems to be justified from the clinical and genetic (Grabb, 1965) points of view, the morphology of the face in both types was not dissimilar and exhibited only quantitative, not qualitative, differences.

reprints: Dr. Leslie G. Farkas
Research Institute
The Hospital for Sick Children
555 University Avenue
Toronto, Ontario.
M5G 1X8

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