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Laterality and Left-sidedness in the Nose, Face, and Body: A New Finding

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Background: Asymmetry is a common occurrence in bilaterian animals, particularly human beings. Through examination of patients and their photographs during rhinoplasty, we noted wider left-sided nasal and facial features in most patients. This observation led us to hypothesize that this might be consistent to the whole body.

Methods: We conducted a study in 3 parts to test the question above. First, we analyzed operating notes of 50 rhinoplasty patients to determine the wider side of the upper, middle, and lower thirds of the nose. Second, we analyzed the width of the face and chest wall in 31 patients to discern any correlation between facial and bodily asymmetry. Third, computerized tomographic scans of the thorax and body of 48 patients were studied to measure the width of the hemithorax and hemipelvic bone.

Results: (1) Upper vault width was wider on left side (78%). Left middle vault width was wider (88%). The lower lateral cartilage, lateral crura convexity was more prominent on left side (48%), and a wider scroll area was found and trimmed in 21 (left) and 0 (right) cases. The alar base was wider on left side (56%). (2) In the body and face analysis, 64.5% had a wider left-sided face and body. (3) In the computed tomographic scan analysis, same-sided thorax and pelvis asymmetry was seen (85.35%), 33 and 7 of which were left- and right-sided, respectively.

Conclusion: We observed generalized asymmetry of the face and body with left-sided predominance. *(Plast Reconstr Surg Glob Open 2017;5:e1590; doi: 10.1097/GOX.0000000000001590; Published online 28 December 2017.)*

INTRODUCTION

Rhinoplasty is the most common aesthetic procedure completed in the Middle East, because mainly of geographical anthropologic distribution that includes noses with larger humps compared with other races. The senior authors of this study (FH, BN) began conducting rhinoplasty procedures 25 years ago, and in this period have scrutinized the anatomy of the nose. Generally speaking, they found that there is a consistent asymmetry between the right and left sides of the nose and also noticed that in the majority of cases, the left side of the nose was wider than the right side. This widening involves the bony vault, middle vault, and tip area. In this study, the authors sought to expand these observations to the whole face and trunk in this population.

Although there are multiple published articles on chirality and anatomic asymmetry,[1,2] most articles discuss the arrangement of internal organs rather than symmetry of the skin and skeleton. We have previously completed asymmetry investigations in the head and neck,[3,4] and in this study, we attempted to compare asymmetry of the left and right sides of the nose, face, and body to discern whether there is a correlation between asymmetry in the upper and the lower parts of the body.

METHODS

This study was composed of 3 different measurements comparing the left and right sides of the body and face.

Measurement 1

We reviewed the charts of 50 consecutive rhinoplasty cases, considering 5 nasal measurement criteria:

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1. We measured width of the upper vault on the basis of osteotomy type, performing lateral osteotomy for the narrower side and lateral and medial osteotomy on the wider side (Fig. 1).
2. For the middle vault, we performed routine bilateral spreader flaps in all cases. To resolve middle vault asymmetry, we kept the recoil force of the upper lateral cartilage[2] (ULC) on the narrower side and added a piece of cartilage as a spreader graft if there was severe concavity (Fig. 2). On the convex side, we made a longitudinal incision on the dorsum of the ULC flap as discussed by Steve Byrd[5] (Figs. 3 and 4). If the convexity was not corrected by this maneuver, we removed small strip of ULC. The width of the middle vault was evaluated on the basis of adding, incising, and/or removing a piece of the ULC.
3. To achieve tip symmetry, we performed transdomal suturing. On the concave side, we either did not use this suture or added alar strut to mitigate the deformity depending on the degree of weakness and depression of lower lateral cartilage. On the convex side, we used single or double transdomal sutures and side mattress sutures as described by R. Gruber[2] (Fig. 5).
4. For lateral wall convexity, we performed scroll area trimming (Fig. 6).
5. We measured the width of the alar base according to the amount of alar base resection.

Measurement 2

Measurement of the width of the face and body was completed for 31 patients (Fig. 7). Cases were selected randomly of those who were referred to our clinic for aesthetic breast surgeries. The marking and measured distances were trichion to cheek and sternal notch to coracoid process.

In the above group, photographs of the face and body were cut in half longitudinally using Photoshop. We then transposed the same half of the face and body on the opposite side, producing 3 pictures for each patient: right–left (normal), right–right side, and left–left side for both body and face (Fig. 8). We then measured the width of both right sides and both left sides of face and body.

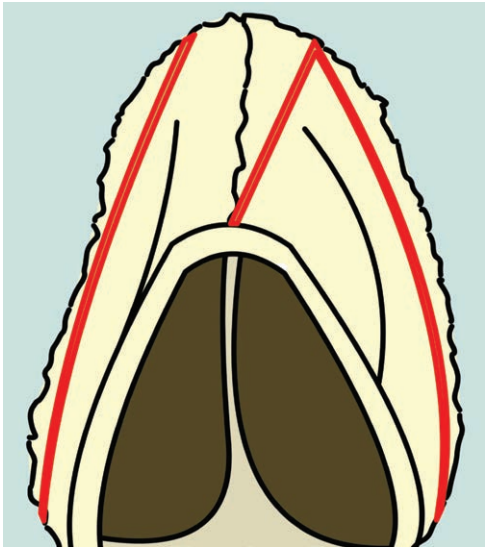

Fig. 1. Asymmetric nasal osteotomy. Lateral osteotomy on the narrower side (right) and double osteotomy on wider side (left).

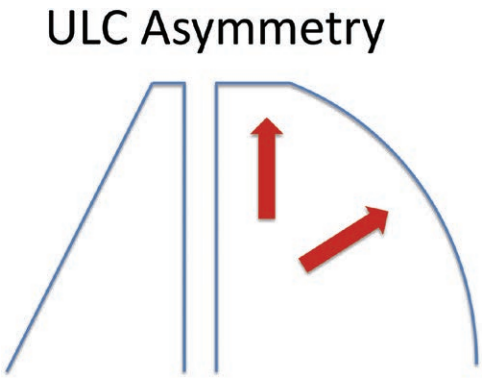

Fig. 2. Common asymmetries of ULCs. There may be asymmetries of both horizontal and vertical components of ULCs.

Measurement 3

We also measured the width of the chest and pelvis skeleton with computed tomography (CT) (Fig. 9). Forty-eight cases were randomly chosen from the radiology department files of patients who received CT of the thorax and abdomen. In the thoracic CT, we drew a line from the posterior spinal process to midsternum, not specifically choosing a specific level in each patient. We drew a perpendicular line to the previous line, and the sides were measured. The same procedure was performed on the abdomen by drawing a line from the posterior spinal process to the mid-symphysis pubis. A perpendicular line to this line passing over the anterior superior iliac spine was drawn, and again both sides were measured.

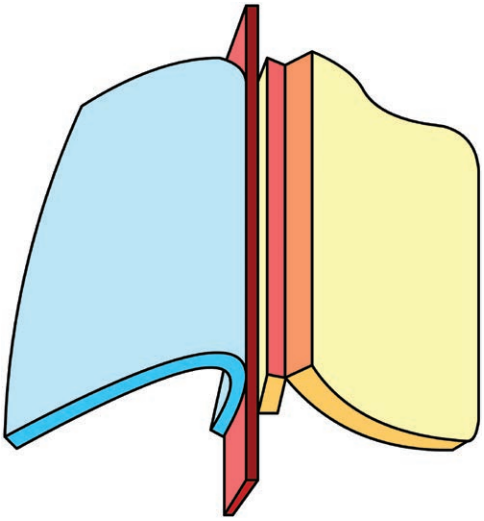

Fig. 3. Management of asymmetric ULCs. On the narrower side, upper lateral flap recoil force is preserved on the right, whereas recoil force is decreased by dorsal incision on the left. A spreader graft can be added to the narrower side if needed.

Fig. 4. A, Narrower ULC on right and wider on left. B, Dorsal cut on left side to decrease the width of ULC flap. C and D, Right ULC flap bent and sutured on itself with no dorsal cut to produce more width on the narrow side. E, ULC is fixed to septum.

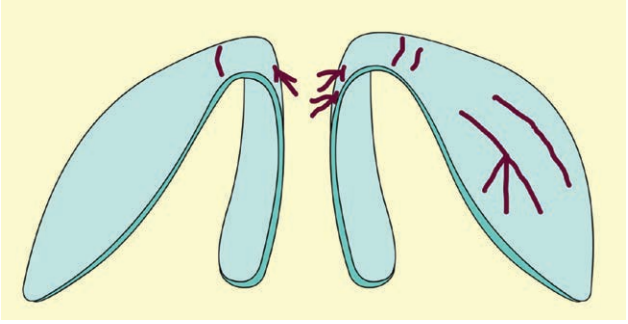

Fig. 5. Asymmetric suturing of lower lateral cartilages to decrease the nasal tip asymmetry. Single transdomal suture on the narrower side (right) and double sutures or lateral side wall mattress suture on the wider side (left).

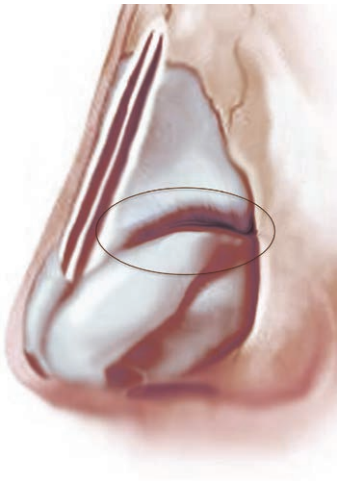

Fig. 6. In the cases of wider lateral wall due to scroll area, minimal trimming was done on this area.

RESULTS

Measurement 1

The results for rhinoplasty cases are outlined in Table 1 and showed the following:

1. We performed symmetric lateral osteotomy in 11 cases. Double osteotomy (medial and lateral) was completed in 39 cases on the left side and none on the right side. Thus, of a total of 50 cases, the left upper vault was wider in 39 (78%) ($P = 0.03$).
2. In addition to the routine bilateral spreader flaps, we added 22 spreader grafts on the right side and only 3 on the left. Spreader flaps were either incised or minimally excised in 44 cases in the left and none on the right ($P = 0.001$).
3. We used alar struts in 11 cases on the right side and 5 on the left side. Lateral wall mattress sutures were applied in 13 cases on the left and none on the right ($P = 0.003$).
4. The scroll area was trimmed in 21 cases on the left side and none on the right side.
5. In 50 patients, alar base width was equal between the right and left sides in 17 patients. In 5 cases, the alar base was wider on right side, and in 28 cases, it was wider on the left (56%) ($P = 0.001$). We showed a significant wider alar base on the left side.

Measurement 2

In looking at different distances on the fixed points of the face and body, the most significant distances were between (1) trichion to cheek ($P = 0.000$) and (2) sternal notch to coracoid process ($P = 0.013$) measurements (Table 2). The result showed that in 20 of 31 cases (64.5%), the face and body were wider on the left side, with only 3 cases (9.6%) showing wider right sides. Eight

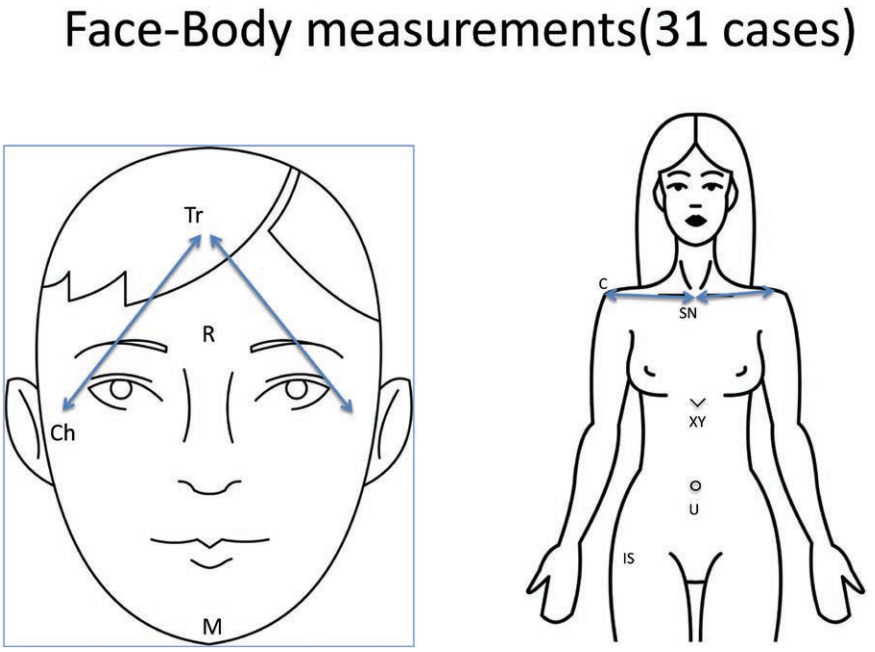

Fig. 7. Body and face measurements. Because of the possibility of nasal deviation, we chose our fixed points as trichion to lateral cheekbone and sternal notch to coracoacromial process.

cases (24.8%) showed similarity between right and left sides. The photograph transposition in 35 cases showed that 24 patients (68%) had wider face and body on the same side with predominance to the left side (n = 15; 42.8%; P = 0.02) (Table 3). There was no significant correlation between the face and body width in each individual, though face and body were significantly wider on the left side.

Measurement 3

In the CT scan group, the results showed a wider left thoracic cage and pelvic bone in 33 of 48 cases (68.75 %)

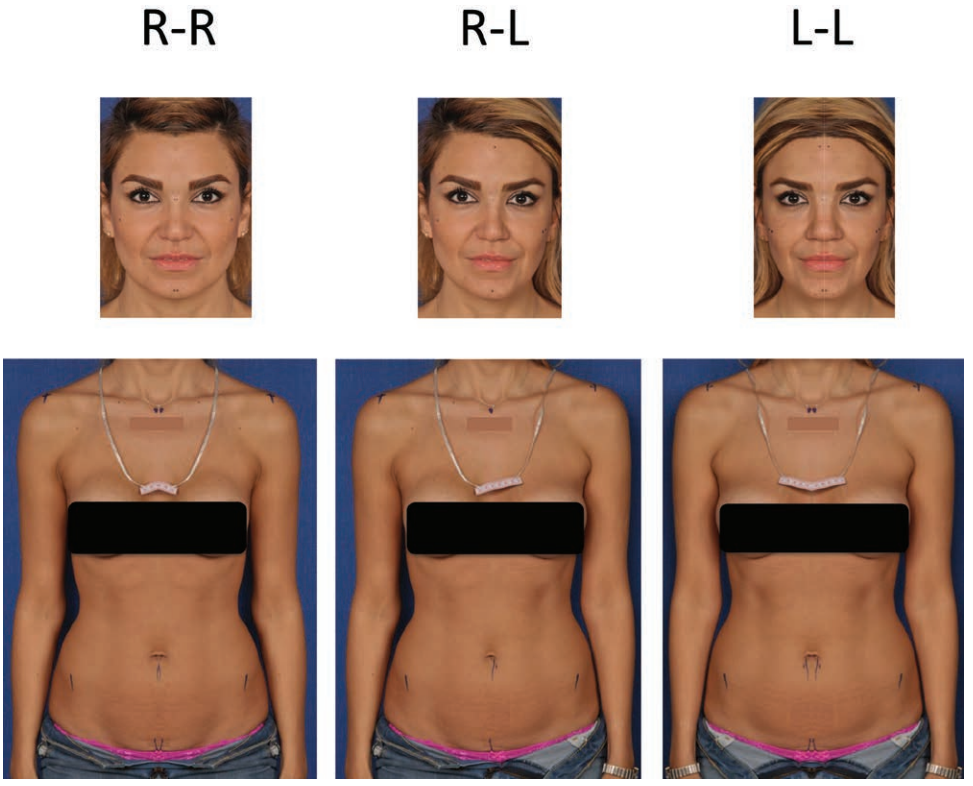

Fig. 8. Image transposition of body and face via 3 photographs: right–right, right–left, and left–left.

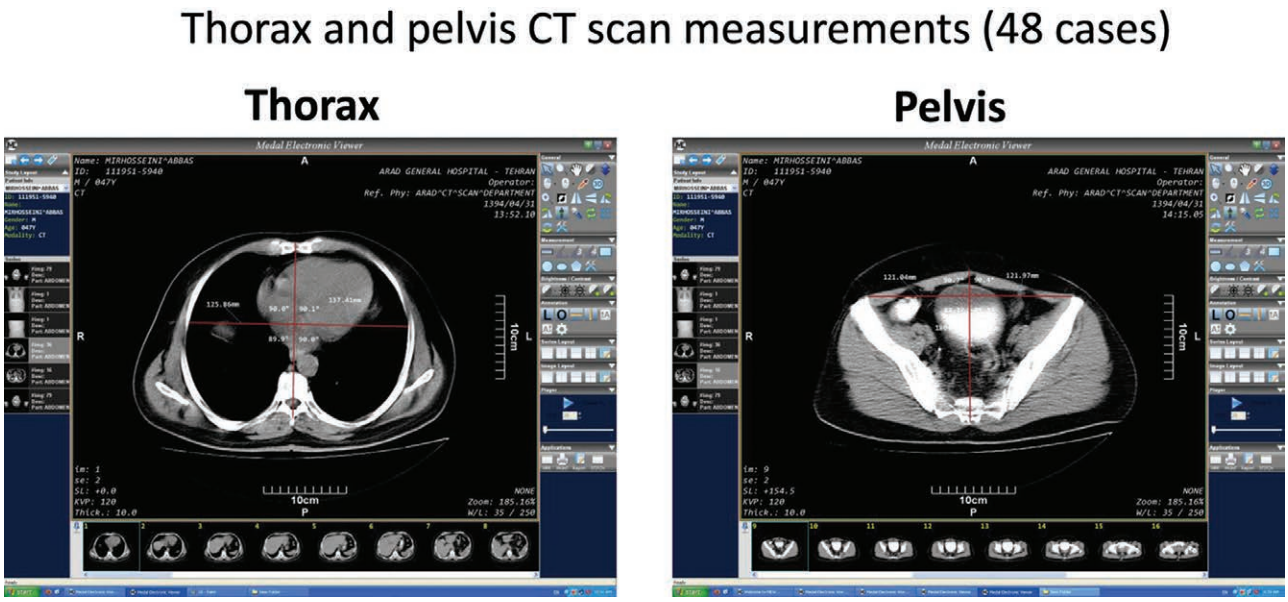

Fig. 9. Measurements of thorax and pelvic bone width in the same patient.

Table 1. Rhinoplasty Results

Double Osteotomy of Nasal Bone		Spreader		Wider Alar Base (No Alar Resection in 9 Cases)		Septum Major Convexity or Deviation			Alar Base Resection			
Right	Left	Right	Left	Right	Left	Right	Left	Midline	Right	Left	Equal	None
0	39	Spreader flap only, 47 Additional spreader, 22	Spreader flap only, 3 Dorsal cut 26, minimal resection: 18	5 17 Right = Left	28	5	20	25	5	28	8	9
0%	78%	Width augmentation, 22 (44%)	Width reduction, 44 (88%)	10%	56%	10%	20%	50%	10%	56%	16%	18%

Significant left-sided widening was noticed in the upper, middle, and lower thirds of the nose. Medial and lateral osteotomy was completed on the left side in 39 cases with no double osteotomy on the right side. ULC width augmentation was conducted with an additional spreader graft to the spreader flap in 22 cases (44%) with width reduction by dorsal cut or minimal resection in 44 cases (88%) on left side. Double lower lateral cartilage sutures and or lateral mattress sutures were applied on the left side in 13 cases (26%) to decrease bulbosity in addition to transdomal suturing on both sides. Wider alar base was noticed on the right side in 5 cases (10%) versus 28 cases (56%) on left side of the nose.

Table 2. Face–Body Measurements (31 Patients), Wider Side

Trichion–Check	Sternal Notch–Coracoid Process	Number of Cases on Each Side
Left	Left	20 (64.5%)
Right	Right	3 (9.6%)
Left–Right	Left–Right	8 (25.8%)

Same-side asymmetry was found in 75% of patients. Sixty-four percent were wider on left.

Table 3. Image Transposition (35 Cases), Wider Side

Left Face and Body	Right Face and Body	Left Face, Right Body	Right Face, Left Body	Right Face, Equal Body
15 42.8%	9 25.7%	4 11.4%	6 17.1%	1 2.8%

A total of 68% had same-side asymmetry; 42.8% were wider on left.

Table 4. Thorax–Pelvis CT Scan Result (48 Cases), Wider Side

Right > Left	Right and Right	Left and Left	Right = Left	Total
7 14.5%	7 14.5%	33 68.75%	1 2.1%	48

This showed 85% same-sided asymmetry with wider left-sided asymmetry in 69%.

compared with only 7 (14.5%) on the right side. In 7 cases (14.5%), the wider distance of the thoracic cage and pelvic bone was not on the same side. In only one case, the right and left sides were equal. This means that in 85% of cases, patients had same-side asymmetry ($P = 0.0015$) (Table 4).

DISCUSSION

Chirality and asymmetry between the face and body are common in many populations. Early Greek scientists were pioneers in exploring internal anatomic organ arrangement, and they believed in symmetry of all body structures. It took years of cadaver dissections to show asymmetric arrangement of internal organs.[6]

How does asymmetry develop? Laterality is controlled by many factors, though genetics have proven to play a

significant role. During the gastrulation phase of development, left to right and rotating movements of nodal cilia results in chiral movement of motor proteins of the cytoskeleton and bulk transport of extracellular morphogens. Genetic data may be translated through pH and voltage gradients across the midline, which will activate left/right asymmetry in the vertebrate embryo.[7]

In recent years, molecular geneticists have made significant contributions to the science of asymmetric vertebrate anatomy and have found that asymmetric animals are evolutionary more progressed than their symmetric ancestors.[8] In bilaterian animals not only are the viscera positioned in an asymmetric manner, but functional left/right asymmetry in brain activity has been proven by psychological testing, magnetic resonance imaging, and lesion analysis.[9]

Human beings and more developed vertebrates normally show left/right asymmetry of the internal organs in addition to the body and skeleton. Lack of this asymmetric development may produce a variety of malformations and disorders.[7,10] Normal asymmetric arrangement of internal organs is called situs solitus. Variation from this normal arrangement is called heterotaxy. Arrangement of organs at random is called situs amigos, and complete reversal or mirror imaged arrangement of organs is called situs inversus.[11] These last 2 patterns are associated with complex cardiovascular malformations, the etiology of which could be due to genetic factors of monogenic, polygenic, or multifactorial origination.[12]

In a long-term study, Swedish researchers found that 50% of immotile ciliary syndrome cases have situs inversus, whereas only 14% of the normal population is left-handed.[13] It appears that there is no relation between these 2 anatomic and physiologic variations.

Contrary to popular beliefs, symmetry does not always translate to beauty. Zaidel et al.[14] found that asymmetric faces often look beautiful in the eyes of others. Indeed, in their study, they created symmetric left/left and right/right composites of "beautiful" faces and chose the most attractive pair members. They found that very attractive faces can often be functionally asymmetric.[14]

In our study, we attempted to find out whether there is a relationship between asymmetry of the face and body or same-sided laterality of the face and body. Another objective was to see whether one side was dominant over the other. Our results showed not only a widening of the nasal wall predominantly on the left side but surprisingly a wider left side of face *and* body structure in the majority of cases. These findings were confirmed by picture transposition and CT measurements of thoracic and pelvic cavities.

Other researchers have also demonstrated left-sided predominance in the human anatomy. In a study of 80 European males, the authors found that measurements of eye socket position in relation to the midline were significantly larger on the left-hand side, meaning a more lateral position of the orbits on that side.[1] In another study, maxillofacial CT scans were obtained from 48 orthognathic surgery cases (24 mandibular retrusion and 24 mandibular prognathism) with facial asymmetry.[15] In an assessment of chin deviation, subjects in this study showed predominantly left-sided deviation regardless of the group studied.

There are other articles on facial laterality showing varying results. Smith et al.[16] measured 2 hemifaces of 45 female and 45 male college students with 2D photographs. They found that females on average had a larger right-sided face in comparison to male subjects, who had a larger left side. The most recent article on this subject was published by Ercan et al.[17] in 2008. They performed precise measurements of 42 facial landmarks (10 midline, 16 right side, 16 left side) on 2D photographs of 321 young college students (150 males and 171 females). They compared multiple distances on both halves of the face and found that the left side of the face was more dominant in both males and females. They also found that the middle third of the face (maxillary bone, zygomatic corner, and lower orbital border) was the most asymmetric part of the face in both sexes.

Similarly, Haraguchi et al. measured facial dimensions at different ages (651 males and 1149 females; mean age of 15 y; range of 4 to 59 y).[18] Asymmetric subjects had 80% wider right-sided hemiface, and 79.3% of those with chin deviation had left-sided laterality. In this regard, during pubertal growth, the proportion of subjects with wider right hemiface decreased ($P < 0.0001$), whereas the proportion of those with a wider left hemiface increased ($P < 0.01$). Confirming the above findings, Farkas et al.[19] also found larger right-sided faces at childhood ages.

Another set of researchers performed cephalometric analysis on 92 volunteers with right/left asymmetry consisting of 8 linear distance, 9 angular, and 3 mid-facial measurements.[20] The result indicated that asymmetry was characterized by a wider left side of the face and a shorter vertical dimension on the right side.

In our study, we believe that asymmetry of the face and the body is a rule, not an exception. Correlation of this asymmetry between the body and face along with left-sided predominance has become noticeable to our authors gradually over the past several decades. Every surgeon, particularly those who are interested in rhinoplasty, should be aware that the right side wall of the nose is narrower than the left, so he/she should be prepared for augmentation or less reduction on the right side versus the left. The significance of these findings serves to enhance existing insight both to patients and surgeons. The patient who is aware of the differential anatomy of his/her body and face will hopefully have a more realistic view about the capabilities of his/her surgeon to produce symmetry and will be less surprised by the outcome of the operation. Our insights can also help surgeons develop a clearer surgical plan to reach a more pleasing and predictable result.

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