Anatomic Variations of Midfacial Muscles and Nasolabial Crease: A Survey on 52 Hemifacial Dissections in Fresh Persian Cadavers

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Abstract
Background: The midfacial region is a challenging area for plastic surgeons and may vary among different races.
Objectives: The aim of this study was to determine the patterns of midfacial muscles in Persian (Iranian) subjects.
Methods: Hemifacial fresh cadaver dissection was performed. For each cadaver, demographics, side of dissection, variation in midfacial muscles (levator alae nasi, levator labii superioris, zygomaticus major [single and bifid], zygomaticus minor, and risorius), midfacial pattern (based on Pessa classification), nasolabial shape (concave, convex, straight) and length were obtained.
Results: Fifty-two hemifacial dissections were performed on 27 cadavers, of which 22 were male (81.4%). The mean age of the subjects was 40.1 ± 14.8 years. The mean of nasolabial length was 46.4 ± 8.3 mm (ranged from 28 to 63 mm). Straight form of nasolabial crease was the most frequent type (n = 26.50%). Levator alae nasi, levator labii superioris, and zygomaticus major were found in 100% of the subjects; however, it was not the same regarding other muscles. The incidence of bifid zygomaticus major was 19.2% (10 hemifacials) in our series. Midfacial pattern type 3 was the most common in our study, which found this type in 21 hemifacials (40.3%). We also found a new type of facial pattern in three cadavers. In this type, which is relatively similar to the type 5 of Pessa’s classification, zygomaticus minor was absent and the zygomaticus major was bifid.
Conclusions: This study revealed that midfacial pattern and nasolabial crease shape are different between Persian (Iranian) and Western subjects. It seems that based on these differences and some other unknown anatomic diversity between different races, some of the defined cosmetic frames may need minor revisions to be applicable for Persian faces. More studies in this field are recommended.

Keywords
midfacial muscular pattern, bifid zygomaticus major, anatomic variation, nasolabial fold, mimetic muscles

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morbidity. Thus, the hypothesis of possible anatomic variations in the pattern of midfacial muscles and the nasolabial fold in Persian patients was suggested. This study was designed to test this hypothesis, with the hope that our results might help surgeons augment their anatomic knowledge about faces from the Middle East.

MATERIALS AND METHODS

After approval from the Ethical Committee of Human Research of Tehran University of Medical Sciences and the Iran Forensic Medicine Organization (IFMO), the study was conducted at the dissection hall of IFMO. Twenty-seven Persian fresh cadavers (52 hemifacials) were dissected. An incision was made in the hairline and extended down toward the ear (anterior of the tragus) and mandibular angle. A second incision was then made on the submandibular fossa, and the flap was reflected to expose midfacial structures. Dissection of facial structures was performed carefully with 2.5 extended field magnifying loops.

A questionnaire was completed for each cadaver by the same author, to assess demographics, presence of midfacial muscles (levator alae nasi, levator labii superioris, single and bifid zygomaticus major, and risorius), length and width of the mentioned muscles, details of the nasolabial crease, and the presence of lateral cheek and submental folds.

Table 1. Frequency of Dental Status for Each Nasolabial Shape

<table>
<thead>
<tr>
<th>Nasolabial Shape</th>
<th>Complete</th>
<th>Denture</th>
<th>Incomplete</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concave</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Convex</td>
<td>12</td>
<td>2</td>
<td>8</td>
<td>22</td>
</tr>
<tr>
<td>Straight</td>
<td>20</td>
<td>2</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>8</td>
<td>12</td>
<td>52</td>
</tr>
</tbody>
</table>

Association between dental status and nasolabial shape was statistically significant ($P = .001$).

Nasolabial crease was categorized as convex, concave, or straight. For length measurement, the distance between the alar base and the termination point of the crease was measured. The position of the termination point varied among different cases and could have been located at the same level or above or below the corner of the mouth. In contrast to earlier reports by Pessa et al., we did not categorize the nasolabial crease as short, extended, or continuous. Midfacial muscular pattern was determined according to the classification described by Pessa and his associates (Figure 1).
Statistical analysis was performed utilizing SPSS Version 16 (SPSS, Inc., an IBM Company†). Chi-square test was used to analyze categorical variables. A $P$ value of less than .05 was considered significant.

**RESULTS**

The mean age of the 27 cadavers (52 hemifacial dissections) was 40.1 ± 14.8 years (mean ± SD). The majority (22; 81.4%) were male. Dental status of the subjects was as follows: 17 (63%) had complete dental anatomy, 4 (14.8%) had dentures, and the remainder (6, 22.2%) were incomplete. A significant association was found between each dental status and the presence of a certain shape of nasolabial crease (Table 1). Lateral cheek and submental folds were found in three (11.1%) and seven (25.9%) cases, respectively. Both folds were more frequently observed in males. Although there was no significant association between gender and lateral cheek fold, a significant association was found between submental folds and gender ($P < .05$).

Nasolabial crease was measured in 23 cadavers. The mean nasolabial length was 46.4 ± 8.3 mm (range, 28-63 mm). The straight form was the most common type of crease (26, 50%). Again, there was a significant association between dental status and nasolabial shape ($P = .001$; Table 1).

Levator alae nasi, levator labii superioris, and zygomaticus major muscles were found in 100% of the subjects; however, the same cannot be said about the other muscles (Figure 2). Midfacial pattern type 3 (as defined by Pessa et al and shown in Figure 1) was the most common in our study, found in 21 hemifacials (40.3%). Table 2 demonstrates the details of midfacial patterns and nasolabial crease shape. We also found a new type of facial pattern in three cadavers. In this type, the zygomaticus minor was absent and the zygomaticus major was bifid (Figures 3 and 4). The incidence of bifid zygomaticus major was 19.2% (10 hemifacials) in our series. The mean length and width of midfacial muscles are shown in Table 3.

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†SPSS was acquired by IBM in October 2009.
Our hypothesis and study design were largely based on earlier work by Pessa et al, which showed variability in the pattern of midfacial and nasolabial fold shape between patients. Variability in midfacial muscles also has been reported by other researchers. However, the results of our study were widely different from those reported by Pessa et al.

We found levator alae nasi, levator labii superioris, and zygomaticus major muscles in all cadavers, which is consistent with the findings of Sato, who reported that zygomaticus major and levator labii superioris are present in almost all individuals. Pessa et al reported zygomaticus minor and risorius presence successively in 6% and 36% of their subjects, respectively, but we found this in 59.6% and 30.8% of our subjects.

Although Pessa and associates concluded that the most frequent type of midfacial pattern is type 1, we found that type 3 is the most common midfacial pattern among Persians. Moreover, we found a new type of midfacial muscular pattern. In this type, all the muscles are present except the zygomaticus minor. In addition, the zygomaticus major is bifid. In essence, it is relatively similar to the type 5 described by Pessa and his colleagues, with the exception of the bifid zygomaticus major. In our study, bifid zygomaticus major was found in 10 hemifacials (19.2%), which is a lower percentage than earlier reports. The incidence of a bifid zygomaticus major muscle was 34% in the study conducted by Pessa and associates. Hu et al reported an even higher incidence, at 40%. This discrepancy between our results and earlier reports also confirms our hypothesis that the underlying anatomy differs depending on the race of the subjects being studied.

Lateral cheek crease was seen in three cases (11.1%) in our study, which was less frequent than in Pessa et al’s data, which showed that 22% of the cadavers had a lateral cheek crease. In fact, lateral cheek crease is considered an anomaly resulting from a fascial connection from the platysma muscle to the dermis. Similar to the earlier study, we found lateral cheek crease more frequently in males; however, the difference was not statistically significant.

Our results were also different from Pessa et al’s with respect to nasolabial crease shape. In their study, convex nasolabial crease was the most frequent type, whereas our findings showed that the straight form may be the most common type in Persian patients. The variability in nasolabial structure, including variation in shape and length due to variation in the location of the termination point, has also been reported by other researchers.

Further studies are needed to fully document and classify differences among races in relation to facial anatomy.

**DISCUSSION**

Our hypothesis and study design were largely based on earlier work by Pessa et al, which showed variability in the pattern of midfacial and nasolabial fold shape between patients. Variability in midfacial muscles also has been reported by other researchers. However, the results of our study were widely different from those reported by Pessa et al.

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**Table 3. Length and Width of Midfacial Muscles**

<table>
<thead>
<tr>
<th>Midfacial Muscle</th>
<th>Number</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levator alae nasi</td>
<td>52</td>
<td>5</td>
<td>12</td>
<td>8.1</td>
<td>1.7</td>
<td>15</td>
<td>34</td>
<td>24.1</td>
<td>4.5</td>
</tr>
<tr>
<td>Levator labii superioris</td>
<td>52</td>
<td>5</td>
<td>18</td>
<td>10.5</td>
<td>3.7</td>
<td>20</td>
<td>65</td>
<td>32.7</td>
<td>8.4</td>
</tr>
<tr>
<td>Zygomaticus major</td>
<td>52</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>42</td>
<td>5</td>
<td>17</td>
<td>11</td>
<td>2.8</td>
<td>53</td>
<td>75</td>
<td>61.3</td>
<td>4.8</td>
</tr>
<tr>
<td>Bifid</td>
<td>10</td>
<td>9</td>
<td>14</td>
<td>11.8</td>
<td>2.1</td>
<td>50/47</td>
<td>65/65</td>
<td>55.3/58.1</td>
<td>5.3/6.5</td>
</tr>
<tr>
<td>Zygomaticus minor</td>
<td>31</td>
<td>3</td>
<td>22</td>
<td>6.8</td>
<td>3.2</td>
<td>30</td>
<td>55</td>
<td>45.5</td>
<td>5.9</td>
</tr>
<tr>
<td>Risorius</td>
<td>15</td>
<td>3</td>
<td>7</td>
<td>4.1</td>
<td>1.1</td>
<td>42</td>
<td>81</td>
<td>61.1</td>
<td>12.4</td>
</tr>
</tbody>
</table>

Min, minimum; Max, maximum; SD, standard deviation.

**Figure 4.** Schematic view of midfacial muscles of new pattern. Note the risorius, levator labii superioris, levator alae nasi, bifid zygomaticus major, and the absence of zygomaticus minor.
CONCLUSIONS

Our results, which document the differences in underlying facial musculature between Persian and Western subjects, may help plastic surgeons enhance their knowledge about the complex anatomy of the midface and nasolabial crease. Based on the anatomic differences and some other potential, unknown diversity between different races, some of the defined cosmetic frames may need minor revisions to be applicable for faces of individuals from the Middle East. More studies in this field are recommended.

Acknowledgments

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