An Evaluation of Soft Tissue Facial Profile in Japanese Young Adults with Normal Occlusion Using Proportional Analysis

Shigeto KISHI and Motō NIWA

Abstract: Lundström et al. described standard values for young Swedish adults with normal occlusion using soft tissue analysis with a natural head position. The purpose of the present study was to determine the standard reference values of young Japanese adults with normal occlusion using the same method of analysis as Lundström. The examiner obtained values for 11 indices (8 horizontal, 2 vertical and 1 horizontal/vertical) from the facial profile photographs of dental school students who had not undergone orthodontic treatment (21 males, 18 females, average age: 23.4 years). The gender and racial differences between the Japanese values and the Swedish values derived from Lundström's report were tested for each index using the t-test. The values for some indices were also compared with those of Peck and Peck for American females. Gender differences for 5 indices were observed (No. 1, 2, 3, 6 and 7). The values for these 5 indices in males were 2-10 points higher than those in females. Racial differences in males for 6 indices were observed (No. 2, 3, 6, 7, 8 and 11). Four of the 6 indices in Japanese males (except No. 6 and 11) were 3-6 points higher than those of Swedish males. Racial differences in females for 5 indices were observed (No. 1, 2, 3, 6 and 7). All 5 indices in Japanese females were 4-10 points lower than those for Swedish females. Therefore, it can be concluded that Japanese males have a more prominent nose, upper and lower jaw, chin and a more eminent chin than Japanese females. There was no common Japanese-Swedish characteristic difference between the two in the comparison of males and females. Japanese females have a less prominent nose and less eminent chin than Swedes and Americans. Gender and racial differences should be considered when using the severity scale of the soft tissue profile for estimating malocclusion.

Key words: Facial soft tissue profile, Proportional analysis, Racial differences

Introduction

Malocclusion is caused by various factors such as occlusal characteristics, skeletal problems, and growth and development of facial complex. Many investigators of orthodontics and epidemiology of malocclusion have studied these factors. Facial soft tissue is also a significant factor which influences the diagnosis of malocclusion\(^1\) and decision making for orthodontic treatment procedures\(^2,3\), and is a major reason for a patient’s decision\(^4\) to undergo orthodontic treatment. However, facial photographs for analysis of soft tissue profile for epidemiological survey are less developed because of the need for large amounts of data storage, and because of the labor and cost of analysis.
Lundström et al. described a standard reference for young Swedish adults with normal occlusion using soft tissue analysis with a natural head position. This method can be applied to epidemiological investigations because of the simplicity of proportional analysis. In other words, non-absolute values are credible in different places and times of epidemiological investigation. In this study, an attempt was made to apply their proportional facial profile analysis to young Japanese adults with normal occlusion as a first step toward establishing the malocclusion severity classification using morphological characteristics of facial soft tissue. To understand the Japanese facial pattern, gender differences in the Japanese and racial differences need to be discussed.

The purpose of this study was to determine the values for young Japanese adults with normal occlusion using the same method of analysis as Lundström. Variability of facial pattern in normal occlusion was also calculated as a measurement for further epidemiological investigation.

**Materials and methods**

Thirty-nine Japanese dental school students (21 males, 18 females, average age: 23.4 years) were selected according to the following criteria:

- Complete dentition, third molars excluded;
- Neutroclusion of the dental arches with normal overbite and overjet;
- Minimal spacing and crowding;
- No history of orthodontic treatment or accidents which would have affected facial growth and development.

Swedish data (20 males and 20 females) derived from Lundström and American data (49 females) from Peck and Peck were used to provide comparisons.

Measurement variables for horizontal and vertical distances are presented in Figure 1. From these 12 variables (7 horizontal and 5 vertical) and 11 indices (8 horizontal, 2 vertical and 1 horizontal/vertical)
Table. 3 Racial differences
—Japanese males and Swedish males—

<table>
<thead>
<tr>
<th>Index</th>
<th>Mean (Japanese)</th>
<th>SD (Japanese)</th>
<th>Mean (Swedish)</th>
<th>SD (Swedish)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Nasal prominence</td>
<td>122.0</td>
<td>7.9</td>
<td>123.6</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>2 Upper jaw prominence</td>
<td>109.9</td>
<td>7.2</td>
<td>103.8</td>
<td>3.3</td>
<td>**</td>
</tr>
<tr>
<td>3 Lower jaw prominence</td>
<td>102.3</td>
<td>8.7</td>
<td>94.9</td>
<td>3.2</td>
<td>**</td>
</tr>
<tr>
<td>4 Upper/lower jaw</td>
<td>107.7</td>
<td>4.5</td>
<td>109.5</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>5 Lip relationship</td>
<td>102.9</td>
<td>2.0</td>
<td>103.1</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>6 Chin eminance</td>
<td>99.7</td>
<td>2.4</td>
<td>102.6</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>7 Chin prominence</td>
<td>102.0</td>
<td>9.4</td>
<td>97.3</td>
<td>3.6</td>
<td>*</td>
</tr>
<tr>
<td>8 Facial convexity</td>
<td>108.8</td>
<td>4.0</td>
<td>105.2</td>
<td>2.6</td>
<td>**</td>
</tr>
<tr>
<td>9 Upper/lower face height</td>
<td>69.6</td>
<td>8.7</td>
<td>71.7</td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td>10 Upper/lower jaw height</td>
<td>50.8</td>
<td>7.9</td>
<td>47.1</td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>11 Face height/depth</td>
<td>119.6</td>
<td>12.8</td>
<td>127.0</td>
<td>5.3</td>
<td></td>
</tr>
</tbody>
</table>

**.p<0.01, *.p<0.05

Fig. 1 Horizontal and vertical distances used for the proportional analysis of the facial profile configuration. The vertical line through Porion (PO) registers the natural head position of subjects. (Derived from Lundström et al.3)

were calculated according to Lundström’s analysis (Table 1).

The differences in the average for each index value between two groups were tested as follows.
1. Gender differences in Japanese subjects
2. Japanese males and Swedish males
3. Japanese females and Swedish females
4. Comparison among the three racial groups
The difference in the average of values for the 6 indices among the three groups (Japanese, American and Swedish female) were tested as follows.
PO-PRN/PO-N (Index No. 1)
PO-SLS/PO-SLI (Index No. 4)
PO-LS/PO-LI (Index No. 5)
PO-PG/PO-SLI (Index No. 6)
SN-ST/ST-ME (Index No. 10)
N-ME/PO-PG (Index No. 11)

Fig. 2 Comparison of nasal prominence among Japanese, American, and Swedish females

Fig. 3 Comparison of upper/lower jaw among Japanese, American, and Swedish females

Results

Gender differences in Japanese
The mean values for the 11 indices are presented in Table 2. Differences were observed for 5 indices (Nos. 1, 2, 3, 6 and 7). The values for all 5 indices were higher for males than for females.
The mean values for the 11 indices studied are presented in Table 3. Differences were observed for 6 indices (Nos. 2, 3, 6, 7, 8 and 11). The values for Japanese males were higher than those for Swedish males with the exception of Nos. 6 and 11. **Japanese males and Swedish males**

The mean values examined are shown in Table 4. Differences were found for 5 indices (No. 1, 2, 3, 6 and 7). The values for Japanese females were lower for all 5 indices than those of Swedish females. **Comparison among the three racial groups**

Comparisons of the average of values for 6 indices among the three groups (Japanese, American and Swedish females) are presented in Figures 2 to 7.
Most PO-PRN/PO-N (Index No. 1) values increased in the following order: Japanese, American, and Swedish. PO-PG/PO-SLI (Index No. 6) was lower in Japanese females than in the other two groups. There were no significant differences among the three groups for PO-SLS/PO-SLI (Index No. 4), PO-LS/PO-LI (Index No. 5), SN-ST/ST-ME (Index No. 10) and N-ME/PO-PG (Index No. 11).

Discussion

Gender differences

Japanese males can be thought of as having more prominent noses, and more prominent upper and lower frontal apical bases in relation to the horizontal position of soft tissue nasion as well as more prominent and eminent chin points than females. Some of the gender differences in Swedes reported by Lundström were not found in the Japanese. These have been categorized into another kind of racial difference which cannot be obtained from direct comparison between two racial groups.

Differences between Japanese and Swedish subjects

The pattern of the differences between Japanese and Swedish males was not the same as in Japanese females. In Japanese males, both the upper and lower jaws and the chin are more prominent than in Swedish males. On the other hand, nose, upper and lower jaws and chin in Japanese females were more retrogressive than in Swedish females. Therefore, there were no common trends between the two in the comparison of males and females, indicating that there are no unique characteristics in the four groups.

Differences among the three geographical groups

Japanese females exhibited less prominent noses and less eminent chins than the Americans or Swedes. This may be mainly due to differences between Mongoloid and white caucasian people. It has been determined that the cranial base in Japanese people is horizontally shorter than in white caucasians. This finding is common for all three populations of Angle's classification of malocclusion. Therefore, a comparison of class II and III malocclusion soft tissue profiles is needed to verify whether or not nose prominence and chin eminence exhibit common tendencies in the three.

Epidemiological aspect

Several estimates and applications of malocclusion indices for epidemiological malocclusion surveys have been described in previous studies. Almost all focus on some occlusal characteristics for practical usage. However, malocclusion has various etiological factors, including TM disorder. It is difficult to establish a method to calculate an index which reflects all these various factors of malocclusion. Therefore, true treatment priorities for population and actual demand for orthodontic treatment have not been explained effectively. The findings in this study may help to improve the malocclusion index. When considering the universal index of facial profile characteristics, racial differences should be minimized to avoid misjudgment when determining whether malocclusion is present or not. In other words, the scale for facial profile should take into consideration to some extent racial differences. Therefore, it is acceptable that test sensitivity for facial profile imbalance screening might be lowered.

Conclusion

1. Japanese males have more prominent noses, upper and lower jaws, and chins and more eminent chins than females.
2. There was no common Japanese-Swedish difference between the two in the comparison of males and females.
3. Japanese females have less prominent noses and less eminent chins than Swedish and American females.
4. The severity scale of soft tissue profile screening should not be affected by racial differences to establish malocclusion index.

References

5) Lundström, A., Forsberg, C.M., Peck S. and MacWilliam, J.: A proportional analysis of the soft tissue profile in young adults with
比率分析による日本人正常咬合者の軟組織側貌評価について

岸 重人 丹羽源男
日本歯科大学歯学部衛生学教室


概要：Lundström らは自然顎位による軟組織側貌分析を考察し、スウェーデン人正常咬合者の基準値を報告している。本研究では同様の方法による日本人正常咬合者の基準値を知ることを目的とした。矯正治療既往のない大学生（男子 21 名、女子 18 名、平均年齢 23.4 歳）の側貌写真から 11 の指数値（水準成分：8, 垂直成分：2, 水平/垂直：1）を計測した。性差及びスウェーデン人との人種差をそれぞれの指数について検討し、6 指数についてはアメリカ白人女子との人種差も検討を行った。この結果、5つの指数（No. 1, 2, 3, 6, 7）について性差が認められ、男子の方が女子より 2〜10 ポイント高かった。また6つの指数（No. 2, 3, 6, 7, 8, 11）について人種差が認められ、No. 6 及び 11 を除く全てが 3〜6 ポイント日本人男性の方がスウェーデン男子より高かった。一方、女子では5つの指数（No. 1, 2, 3, 6, 7）について人種差が認められ、4から10 ポイント日本人の方が低かった。従って日本人男子はより前方位の鼻、上下顎、オトガイ及びより輪郭の明確なオトガイを有する傾向がみられた。しかし日本人とスウェーデン人との比較では男子と女子に現れた人種差に共通した特徴は認められなかった。また日本人女子はスウェーデン人及びアメリカ白人比に比べより後方位で輪郭の明確でないオトガイを有していた。これらから軟組織側貌による重篤度判定にはこれらの性差や人種差を考慮した重み付けが必要であることが望ましいと考えられる。

索引用語：軟組織側貌、比率分析、人種差

著者への連絡先：岸 重人 〒102 東京都千代田区富士見 1-9-20 日本歯科大学歯学部衛生学教室
電話 03-3261-8311 内線 341