

## Different Approaches to Orthodontic Treatment Based on the Characteristics of Dento-Craniofacial Morphology in Caucasians and Japanese

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### Summary

Recently, with the increasing opportunities for global travel and the immigration of peoples, orthodontists may be required to treat patients of different racial origin. It is imperative to understand the morphological difference between racial groups to appreciate the aetiology of the malocclusions, and hence, to ensure that treatment is appropriately directed.

This clinical topics outlines some of the differences in the morphology, aetiology, and orthodontic treatment outcomes for Japanese and Caucasian populations.

### Aetiology of malocclusion

It is well known that either Angle Class II or skeletal Class 2 malocclusion is one of the most common malocclusions in the Caucasian population<sup>1,2</sup>, whilst in Japanese the incidence of Angle Class III malocclusion or skeletal Class 3 pattern is much higher<sup>3,4</sup>. Enlow<sup>5</sup> reported that ethnic groups with a brachycephalic headform (Figure 1 A and B) are likely to have relative retrusion of the naso-maxillary complex with a more anterior placement of the entire mandible, resulting in a greater tendency towards a Class III profile. These racial growth characteristics may influence the results of orthodontic treatment. Although Deguchi et al.<sup>6</sup> reported that early (mean age, 4 years 2 months) face mask therapy resulted in a significant advancement of the maxilla at a mean follow-up period of 7 years 5 months, the absence of an increase in SNA angle at post-retention (mean age, 11 years 0 months) indicated that the genetic growth trend in a Japanese Class III sample with a brachycephalic headform predominated over the orthopaedic effects obtained after treatment.

Not only skeletal Class 3 but also Class 2 malocclusion may result in a different treatment outcome. Skeletal Class 2 in Chinese population manifests a more protrusive maxilla and retrusive mandible compared with Caucasians<sup>7</sup>. Furthermore, skeletal Class 2 pattern is associated with not only horizontal but also vertical problems, either division 1<sup>8,9</sup> or division 2<sup>10</sup>. In Japanese, the angle of Frankfort plane to mandibular plane is greater than in Caucasians. These differences in skeletal



Fig. 1 A

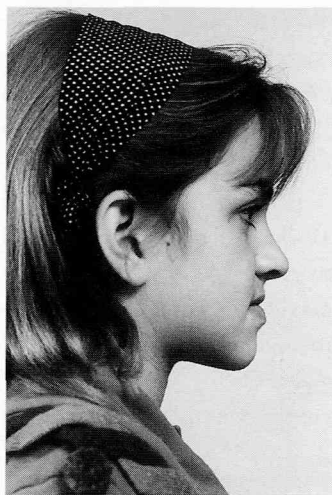


Fig. 1 B

**Fig. 1 A :** Lateral photo of a skeletal Class 3 Japanese girl at pretreatment.

**Fig. 1 B :** A skeletal Class 3 Caucasian girl at pretreatment. Note a difference in the angle of Frankfort plane to mandibular plane and anterior facial height.



Fig. 2 A



Fig. 2 B

**Fig. 2 A :** Lateral head film of same Japanese girl.

**Fig. 2 B :** The same Caucasian girl. Note the differences in skeletal morphology between two girls.

morphology may indicate less horizontal growth of the mandible associated with skeletal Class 2 malocclusion in Japanese.

For excessive vertical growth of the mandible, Japanese adults show a longer lower facial height associated with a dolichofacial pattern, compared with that of Caucasians<sup>11,12)</sup> (Figure 2 A and B). This characteristic morphology in growing Japanese patients may indicate that mechanical clockwise rotation of the mandible should be avoided or carefully controlled during treatment.

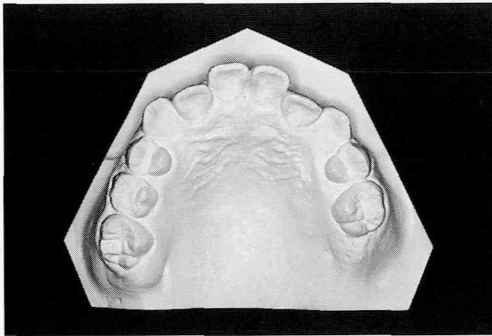
### Size and shape of teeth

The size of teeth in the Asian population, including Japanese, is larger than that of the Caucasians<sup>13, 14)</sup> (Figure 3 A and B). Large maxillary incisors may have a protrusive position leading to an increased overjet, thus increasing the likelihood of extraction treatment if necessary in combination with a reduction of tooth size through interdental stripping of the maxillary incisors.

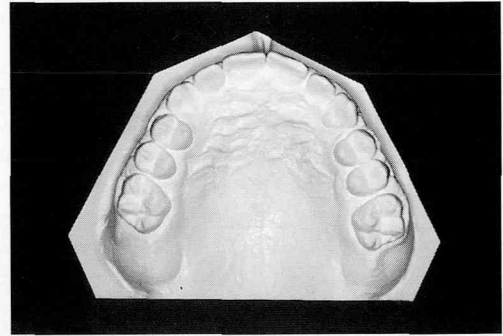
Furthermore, the shape of the anterior teeth in Japanese is characterised anatomically as shovel teeth<sup>15)</sup> (Figure 3 A) which frequently results in 3 or 4 mm of overjet anatomically. When over-correction of a large overjet in the Angle Class II malocclusion is needed, trimming or flattening of the lingual surface of maxillary incisors is often necessary to obtain an edge to edge incisor relationship or 1 mm overjet with an ideal overbite.

### Shape of the dental arch

The ovoid shape of the dental arch in Japanese represents a brachycephalic pattern while the V-



**Fig. 3 A**



**Fig. 3 B**

**Fig. 3 A :** Maxillary dentition (pretreatment record) in Japanese girl.

**Fig. 3 B :** Maxillary dentition (progress record) in Caucasian girl. Note the differences in the size of teeth and the incisors in Japanese girl show a so called "shovel teeth".

shaped dental arch in Caucasians corresponds to a dolichocephalic pattern. The most popular treatment approach for growing patients with skeletal Class 3 is a combination of expansion and protraction of the maxilla<sup>16, 17, 18)</sup>. However, skeletal Class 3 malocclusion in Japanese is less likely to show a need for maxillary expansion because of the wide maxillary arch<sup>18)</sup>.

### Soft tissue profile

The priority of treatment is a good profile. Mongoloid individuals show a low nose and less prominent chin which affect the protrusive profile associated with the cephalometric measurements of the "Esthetic line"<sup>19)</sup> when compared with Caucasians (Figure 4 A and B). In general, Japanese patients show little variation in the nose and chin morphology between individuals and therefore the "Esthetic line" can be considered the ideal measurement to accurately determine the position of the lips. The mean value for the upper lip to E line in young Japanese adults is 1 mm compared with -2 mm in Caucasians, whereas the lower lip to E line is 2 mm and -4 mm in Japanese Caucasians respectively<sup>19, 20)</sup>.

Japanese patients tend to exhibit a retrusive profile, resulting in more extraction choice. In comparison, Caucasian adults tend to show a "dished in" face<sup>21)</sup>. Since the start of the debate on the relationship between extractions and TMJ disorders in the mid 1980's<sup>22, 23)</sup>, non-extraction treatment

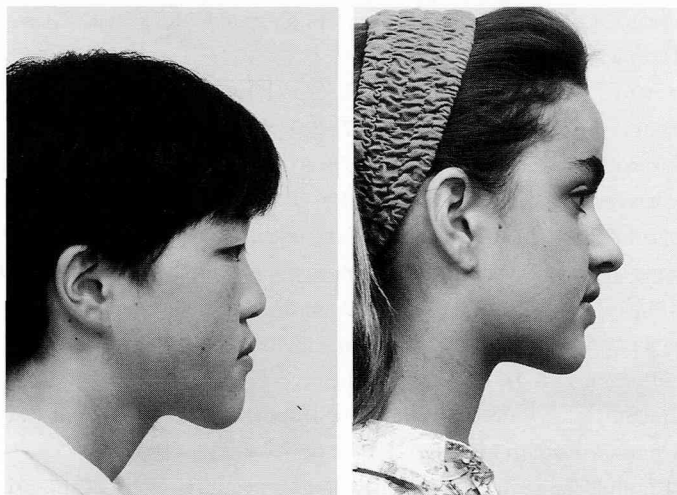


Fig. 4 A

Fig. 4 B

**Fig. 4 A :** Lateral photo of Japanese girl at the post-treatment.

**Fig. 4 B :** Caucasian girl at the post-treatment. Note a long face in Japanese girl and the difference in Esthetic line (upper and lower lips to nose-chin line) between two patients.

has become popular in the USA. The method of non-extraction treatment is mainly based on widening the dental arch, expansion of the basal arch, posterior movement of molars and a little flaring of the incisors.

As mentioned above, these four procedures are not beneficial to the dento-craniofacial morphology in Japanese patients, particularly in borderline cases. With globalisation of the world, orthodontists in regional countries are more likely to treat patients of different races. This clinical topics outlines differences in the morphology, diagnosis, treatment planning and outcome of orthodontic treatments among various ethnic groups.

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抄録：日本人と白人における歯・顎顔面形態の特徴に基づいた矯正治療のアプローチについて

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今日, 世界的規模で多くの人々が移住者や旅行者として生活する機会が増加するに伴って, 矯正歯科医は他民族の患者の治療をすることが要求されつつある。それに対処するには, まず民族間での歯, 顎顔面形態の差異を十分に理解することが必要であり, その上で不正咬合の原因論を正しく認識し, 適切な治療法を確立すべきであると考えられる。

この臨床的話題は, 上記の人種間の違いを日本人と白人の症例を呈示して, その形態学的, 原因論的そして矯正治療後の状態について幾つかの相違点を略述した。