Class II Division 2 malocclusion: Genetics or environment? A case report of monozygotic twins

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Abstract: A pair of monozygotic twins with different malocclusion phenotypes (Class II Division 2 and Class II Division 1) is presented. The case report supports the hypothesis that heredity is not the sole controlling factor in the etiology of Class II Division 2 malocclusion.

Key Words: Class II Division 2, Etiology, Twin studies, Genetics

The Class II Division 2 malocclusion (II/2), first defined by Angle[1] in 1899, has an incidence rate of 1.5% to 7%.[2-5] Its etiology is generally believed to be genetic, and familial occurrence has been documented in several studies of twins and triplets.[6-8] Some authors consider factors such as a high lip line,[4,9-11] hyperactive lip or mentalis muscles,[12-17] and increased masticatory bite forces[18-19] to be of main importance. Others stress morphologic and growth factors, such as an upright incisor position,[12,15,20] small tooth size,[5] increased collum angle of the upper incisors,[3,21] thin incisors with small tubercula,[22] decreased vertical jaw development,[9,20,23] overdevelopment of the interincisor bone or upper anterior alveolar process,[4,13,19,20,24] and anterior rotation of the mandible.[25]

Case report

A pair of monozygotic male twins is presented. The boys exhibited a marked similarity in facial appearance (Figure 1). Their occlusions, however, were remarkably different. One boy (Figure 2) had a Class II Division 2 malocclusion (II/2) with half a cusp distal occlusion in the molar region, an overjet of 1 mm, and a deepbite (overbite = 7 mm), while his brother (Figure 3) had a Class II Division 1 malocclusion (II/1) with half a cusp distal occlusion in the molar region, an overjet of 12 mm, and a deepbite (overbite = 5 mm). According to the mother, there was a history of finger sucking in twin II/2 (!) but not in twin II/1, who presented a lower lip dysfunction during swallowing, placing the lower lip behind the upper front teeth.

The radiographic cephalometric analysis revealed no differences in skeletal morphology (Figures 4, 5), although they did differ in the inclination of the upper incisors, with the teeth retroclined in twin II/2 and proclined in twin II/1. Superimposition of the tracings from the lateral cephalograms of twin II/2 and twin II/1 (Figure 5) showed that there was no absolute difference in upper lip position. However, relative to the position of the upper incisors, twin II/2 exhibited a high lip line.

Both boys were treated successfully with removable and fixed orthodontic appliances (upper plate, activator, multibracket appliance) over a period of 4 years (Figures 6, 7, and 8). The only difference in orthodontic treatment between the boys consisted in a proclination of the upper incisors previous to functional appliance treatment in twin II/2. The posttreatment superimposition of the cephalometric tracings showed no real difference in dentoskeletal morphology between the two boys (Figure 9).

Discussion

Discordancy for malocclusion in dizygotic twins is a frequent find-

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Figure 1
Pretreatment facial photographs of twin II/2 (left) and twin II/1 (right) at 10 years

ing.[7] However, malocclusion discordancy in monozygotic twins has, to our knowledge, been reported only by Leech[26] in 1955. As in the present case report, one of Leech's twins exhibited a Class II/2 malocclusion and the other a Class II/1 malocclusion.

In agreement with several cephalometric studies, we found that Class II/2 malocclusions exhibit no distinct skeletofacial pattern.[12,27-29] Pancherz et al.[29] showed that, except for the position of the maxillary incisors, no difference exists in dentoskeletal morphology when comparing Class II/1 and Class II/2 malocclusions. This was also true for the present pair of twins.

Angle[9] claimed that a high lip line was the main etiologic factor in the development of Class II/2 malocclusions. Interestingly, the absolute vertical positions of the upper and lower lips in the twins were iden-

Figure 2A

Figure 2
Pretreatment facial profile, frontal and lateral intraoral photographs of twin II/2 at 10 years

Figure 3A

Figure 3A-C
Pretreatment facial profile, frontal and lateral intraoral photographs of twin II/1 at 10 years

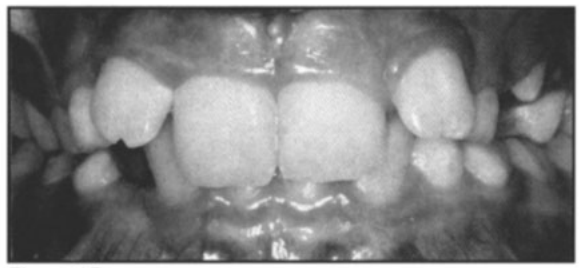

Figure 2B

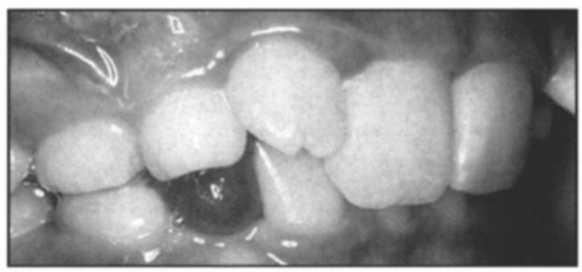

Figure 2C

Figure 3B

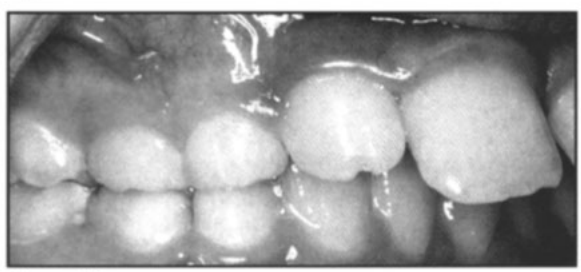

Figure 3B

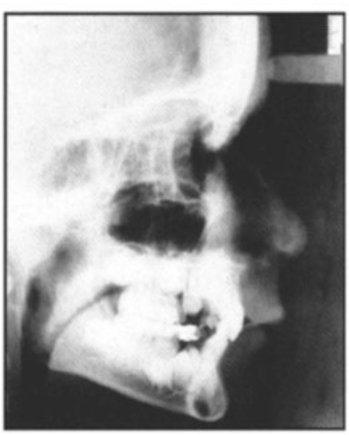

Figure 4A

Figure 4B

Lateral cephalograms of twin II/2 and twin II/1 at 10 years

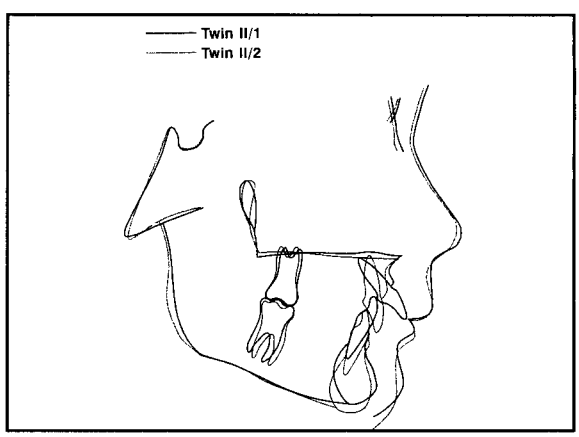

Figure 5
Pretreatment superimposed tracings of the lateral cephalograms of twin II/2 and twin II/1 at 10 years

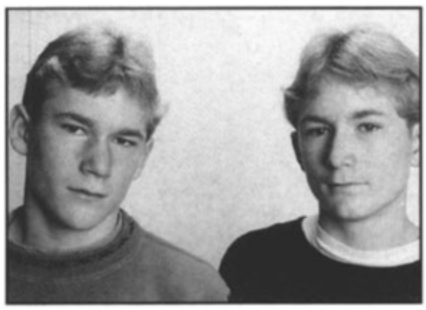

Figure 6

Posttreatment facial appearance of twin II/2 (left) and twin II/1 (right) at 15 years

tical. However, relative to the position of the upper incisors, twin II/2 exhibited a high lip line, which was also the case in Leech's [26] twins. This finding suggests that it is not primarily lip position that is responsible for the difference in incisor inclination, but rather incisor position itself.[12,20] Another explanation might be a difference in the functional pattern of the lip musculature.[12-17] However, if incisor position is genetically determined,[12,20] the question is: What caused the difference in upper incisor position in the identical twins? Is it the functional pattern of the lip musculature as both II/1 twins—Leech's[26] and the present—exhibited an atypical swallowing pattern (placing the lower lip behind the upper incisors)? And is this lip dysfunction a primary pattern or is it the result of the proclined upper incisors? Or is the mother mixing up her boys? Is it twin II/1 who had a history of finger sucking and not twin II/2? The mother disagrees, but if it is the case, then function could overcome the genetically predetermined pattern.

Conclusions

The etiology of the Class II/2 malocclusion remains unclear. Neither form nor function seems to be the sole controlling factor. There are many open questions, and further research is necessary to elucidate the true etiology of the Class II/2 malocclusion.

Figure 7A

Figure 7A-C
Posttreatment facial profile, frontal and lateral intraoral photographs of twin II/2 at 15 years

Figure 7B

Figure 7C

Figure 8A

Figure 8A-C
Posttreatment facial profile, frontal and lateral intraoral photographs of twin II/1 at 15 years

Figure 8B

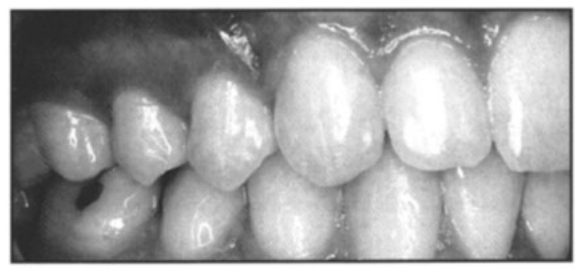

Figure 8C

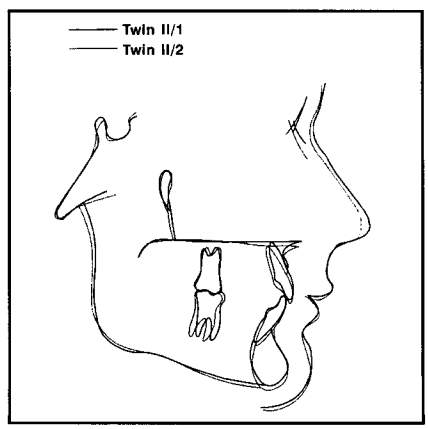

Figure 9
Posttreatment superimposed tracings of twins' lateral cephalograms at 15 years

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