

## Family-Related Maxillary Deficiency Accompanied by Delayed Permanent Dentition: A Case Report

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### Abstract

Class III malocclusion is relatively present in everyday clinical orthodontic practice. Clinical presentation usually may vary from mild to extremely severe forms which are pretty dramatic for the human eye. The aim is to present a family-related class III malocclusion with deficient maxilla combined with delayed permanent teeth eruption. Two cases of a brother and sister with similar, yet not identical characteristics are presented. According to the cephalometric analysis, both patients presented with a maxillary deficiency in different degrees, and delayed eruption of the permanent teeth. Also, midfacial deficiency is notable.

As a conclusion, we suggest a deeper clinical diagnostic protocol, taking into consideration, not just the clinical examination, but the overall evaluation of systemic health. Also, anamnestic data taken from the birth, pregnancy, or any other problem that may be related to the current condition. The clinical extraoral and intraoral examination should always be taken with caution in defining the final diagnosis; nevertheless, the deeper diagnostic protocol can reveal hidden problems. Further evaluation and follow-ups of the patient's condition are necessary. Genetic examination with a referral from a pediatrician would be of benefit in both cases.

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### Introduction

In 1899, the father of modern orthodontics, Edward Hartley Angle, classified malocclusions in Class I, Class II, and Class III. This classification was done according to the permanent first maxillary and mandibular molars relationship and alignment of teeth with orientation to the line of occlusion. Later, Angle's classification has been improved, and additional data including jaw relationship and the growth pattern were also encompassed. Therefore, the Class III jaw relationship is related to the mandible's more forward, mesial positioning, related to the maxilla and the cranial base.<sup>1,2</sup>

Class III malocclusion is considered an arduous disorder of the maxillofacial system, characterized by concave facial profile, usually

accompanied by the severe or mild mandibular protrusion, maxillary retrognathism, prognathism, or some other possible heterogeneity of this malocclusion.<sup>1, 2, 3</sup> The existence of familial aggregation of mandibular prognathism suggests that genetic components play an essential role in its aetiology.<sup>4, 5</sup> However, the combination of Class III malocclusion with a delayed eruption of the permanent teeth is not common in nonsyndromic patients, and its discussion is rare in the literature. This case report of a brother and sister with similar anatomic features presents an unusual combination of symptomatology, where underdeveloped maxilla and delayed permanent dentition are evident.

### Case Reports

A 9-year-old girl and an 8-year-old boy (brother and sister) with their parents sought treatment at the University dental Clinique, department of orthodontics. After extraoral examination protocol and anamnesis, they were referred for radiographic examination. The anamnestic data taken from their parents

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revealed a family-related problem, where the children's grandfather exhibited relatively the same facial features as the children, with a prominent lower jaw.

### **Case 1**

#### Extra-oral Assessment

The extraoral examination (Fig.1 A) presented long dolichofacial anatomy with a prominent forehead and prominent eyes – exophthalmos. Asymmetry of the eyes is evident. Also, asymmetry in the vertical plane is notable. A deviation of the nose to the right side and lateral deviation of the mandible to the right is also noted. The anamnesis revealed nonpast orthodontic treatment. Profile analysis exhibits a concave profile. The Ricketts' aesthetic (E-Line) revealed protruding lower lip. It was evident that the face is asymmetrical on measuring the lines bipupilar and smile line in the transversal plane of space. The median of the face deviates to the right related to the medial facial line and body line. Angular measurements of the face exhibit an obtuse frontonasal angle with a higher value than the average, 150 degrees out of (115-135) mean value range. The nasolabial angle is average, and the mentolabial angle is above the mean value. The extraoral examination showed that lips are competent, and exposure of the upper frontal teeth on smiling is 100%. The upper lip follows the upper line of teeth. Sagittal relation of the upper and lower arch measured in the canine region, is in Angle Class III, with a negative overjet of 3mm in the front. Also, bilateral crossbite in the transversal plane of space is present.

#### Intra-oral Assessment

The intraoral examination (Fig.1 B) revealed early mixed dentition with cavities on the deciduous first and second upper molars. Oral hygiene is satisfying, and motivation is externally induced. Cavities on the second lower deciduous molars were identified. Intraoral examination revealed delayed eruption of the permanent teeth, which does not correspond with the patient's chronological age. The intraoral situation corresponds to a case of a child aged between 5 and 6 years. The maxillary dental arch is short and does not correspond to the chronological age but does correspond with the actual situation. The circumstances did not allow performance on model analysis, due to the situation of unerupted teeth.

#### Radiographic examination

*Orthopantomogram* (OPG) (Fig.2 A) reveals presence of all permanent teeth. Due to the delayed permanent eruption (dentitio tarda), dental maturation of the teeth was analyzed, and Demirjian Analysis was used as a method for this evaluation.<sup>6</sup>

This analysis did not reveal any stagnancy related to the chronologic and skeletal maturation. According to Demirjian's analysis, the stage of maturation of teeth corresponded to the age of 8,7 - 8.8 years. This was in correspondence to the chronological and skeletal age of the patient.

#### Cephalometric evaluation

The cephalometric analysis reading of the cervical vertebral maturation was in correspondence with skeletal maturation stage 2 and resembled the acceleration stage. Further expected growth was estimated between 65% - 85%. (Fig. 2 C, D) The overall diagnostic protocol also included analysis of the *hand and wrist*, (Fig.2 B) and it was performed for the finalization of the diagnosis. This analysis revealed smaller diaphysis related to the epiphysis. The sesamoid bone is not present yet, and the radius is not fused. Performed comparison with the photo atlas corresponds with the age of a girl between 7-8 years.<sup>7</sup>

The *cephalogram* (Fig.2 C, D) shows a vertical growth pattern combined with maxillary retrognathism and mild mandibular retrognathism, skeletal class III with open bite tendency. Dental parameters revealed retroclined lower frontal incisors. The overall symptomatology was unclear and gave a suspicion of a mild form of cranial syndromic synostosis (Crouzon Sy.). Parents were given a referral for a genetic examination but refused further examination with an explanation that they don't need it, as the kids are healthy and hyperactive, despite our permanency in the decision for genetic examination.

### **Case 2**

#### Extra-oral Assessment

The long dolichofacial anatomy with a prominent forehead that was noted in Case 1 was also noted and even further emphasized in Case 2 (eight-year-old brother) (Fig. 3 A). In Case 2, eye asymmetry was not detected. The nose was small and symmetrical, with flattening in the root of the nose. Mild deviation of the chin to the right side, in the region of the lower-mandibular third was present. The anamnestic

data taken from the parents did not reveal previous orthodontic treatment. The anamnestic evaluation revealed that the boy has some degree of hearing loss. For further examination, a referral to an otorhinolaryngologist was given, in order to clarify the hearing loss problem. Oral hygiene is satisfying and motivation is externally induced. As in Case 1, a positive family anamnesis was given, according to which the grandfather was said to have had a prominent chin. Profile extraoral analysis exhibited a concave profile. The face is symmetrical on transversal measurements, measuring the discrepancy between bipupilar and smile lines. The median line of the face slightly deviates to the right in the level of the lower – mandibular facial third. Vertical measurements reveal that all three-thirds of the face are equal. The Ricketts' aesthetic (E-Line) revealed protruding lower lip. The facial fives assessment reveals the same size of every 1/5th, which goes in addition to the already mentioned facial symmetry.

Angular profile measurements reveal slightly increased frontonasal angle (150 degrees). The nasolabial angle is above the average value and is 120 degrees. The mentolabial angle is also above the mean value and is measured 150 degrees. On extraoral examination, it is evident that lips are competent, and exposure of the upper frontal teeth is 100%. The upper lip follows the upper line of the teeth.

#### Intra-oral Assessment

Intraoral examination revealed (Fig.3 B) early mixed dentition with permanent upper and lower first molars present. Also, lower permanent central incisors are present. The maxilla is smaller in sagittal, transversal, and vertical planes. Sagittal relation of the upper and lower arch is in Angle Class III and is measured in the canine region. A negative overjet in the sagittal plane and unilateral crossbite on the right side in the transversal plane of space are present. Deviation to the right also is notable. The intraoral finding corresponds with a child aged 5-6 years. Oral hygiene is satisfactory.

#### Radiographic examination

The OPG (Fig.4 A) reveals a presence of all permanent teeth with no supernumerary teeth. The Demirjian analysis <sup>(6)</sup> was performed once again to evaluate the mineralization of the permanent teeth. According to the findings of the analysis, the mineralization of the permanent dental tissue corresponds to an age of 8-8.1

years. According to the cervical vertebral maturation (Fig.13), the skeletal maturation was in stage 1 and corresponded with the initial adolescent growth stage. The expected growth shortly is 80% - 100%. The overall diagnostic protocol also included analysis of the *hand and wrist* (Fig.4 B), and It was performed for the finalization of the diagnosis. This analysis revealed that diaphysis is smaller related to the epiphysis. A sesamoid bone is not present yet and the radius is not fused yet. Performed comparison with the photo atlas corresponds with the age of a boy between 6-7 years. <sup>(7)</sup>

#### Cephalometric Analysis

Cephalometric analysis (Fig.C, D) revealed a regular growth pattern, with no rotation detected on cephalometric evaluation. Mild maxillary retrognathism with mild mandibular prognathism and skeletal class III. An open bite tendency was noted.

#### Suggested treatment plan

Extraction of the upper central deciduous incisors was suggested. As both patients were in a favorable growth phase according to the skeletal radiographic measurements, treatment for class III with myobrace i-3<sup>N</sup> was proposed, for obtaining orthopedic effect. This treatment plan proposal was based on the patient's expected compliance.

### **Discussion**

Class III malocclusion has been considered an arduous disorder of the maxillofacial system, characterized by concave facial profile, usually accompanied by severe or mild mandibular protrusion, maxillary retrognathism, prognathism, or some other possible heterogeneity of this malocclusion. Usually, it is accepted that Class III malocclusion is primarily an inherited problem, but recently, epigenetics has also taken place in the development of this malocclusion. <sup>1</sup> Phenotype categorization of this anomaly is associated with diverse expressions of the genotype, which is an important step in establishing the genetic influence on class III malocclusion. Cranial cephalograms are an economical and suitable tool that provides rich phenotypic data for the facial and cranial bony structures and the soft tissue anatomy. <sup>1, 2, 3, 4</sup>

The familial aggregation of mandibular prognathism suggests that genetic components

play an essential role in its aetiology. Many lines of evidence suggest a genetic aetiology of class III malocclusion. However, a wide range of environmental factors has been suggested as contributing factors for the development of class III malocclusion. The familial aggregation of mandibular prognathism has also been described and attributed to various genetic models, including autosomal recessive, autosomal dominant, and polygenic transmission models.<sup>4, 5</sup>

This case report presents family-related maxillary deficiency in combination with delayed permanent dentition. The average eruption period of the upper front teeth is around the age of 7-8 years. The delayed eruption is considered above eight and a half to 9 years.<sup>8,9</sup> However, many studies claim the influence of genetic factors control on tooth emergence. Teeth eruption can be affected by certain genetic disorders. A great part of them is stated to delay permanent teeth eruption, while others are related with complete failure teeth to erupt. In addition, other factors that influence the timing of the permanent tooth eruption are nutrition, socioeconomic status, body height, and weight, systemic diseases, hormonal factors.<sup>10</sup> Other studies<sup>11, 12</sup> showed that development and eruption of the maxillary teeth, especially molars,

are delayed in skeletal Class III patients. In a few studies was concluded that variables influencing delayed eruption were palatal length and chronological age.<sup>11, 12</sup>

On the other hand, in both of our cases, it was concluded that there is no considerable delay in the skeletal age, in relation to the chronologic age. Also, the mineralization of the teeth is estimated in the average age range related to the chronologic age. The only problem this study refers to is the combination of underdeveloped midfacial structures and delayed eruption of the permanent teeth which can be explained with the lack of space for permanent dentition eruption in the alveolar arches. Since the problem in upper permanent teeth eruption can be addressed on the deficiency of the maxilla, which is not developed enough in the sagittal, transversal, and vertical planes of space, the situation remains unexplained for the lower jaw. Also, the aetiology of the maxillary deficiency in these two cases is a very complex problem, because many factors, as mentioned above in the previous studies, can influence it. Several other examinations would be helpful, including genetic examination for a present syndrome, or hormonal examination, nutritional status, etc.



Figure 1.

A. Extraoral facial features. Extraoral examination presented long dolichofacial anatomy with a prominent forehead and prominent eyes – exophthalmos. Asymmetry of the eyes is evident, also vertical asymmetry is notable. Facial asymmetry follows the deviation of the nose to the right side and lateral deviation of the mandible to the right

B. Intraoral clinical finding. The examination revealed early mixed dentition with cavities on the deciduous first and second upper molars. Also cavities on the second lower deciduous molars were identified. Intraoral examination revealed delayed eruption of the permanent teeth, which does not correspond with the patient's chronological age.

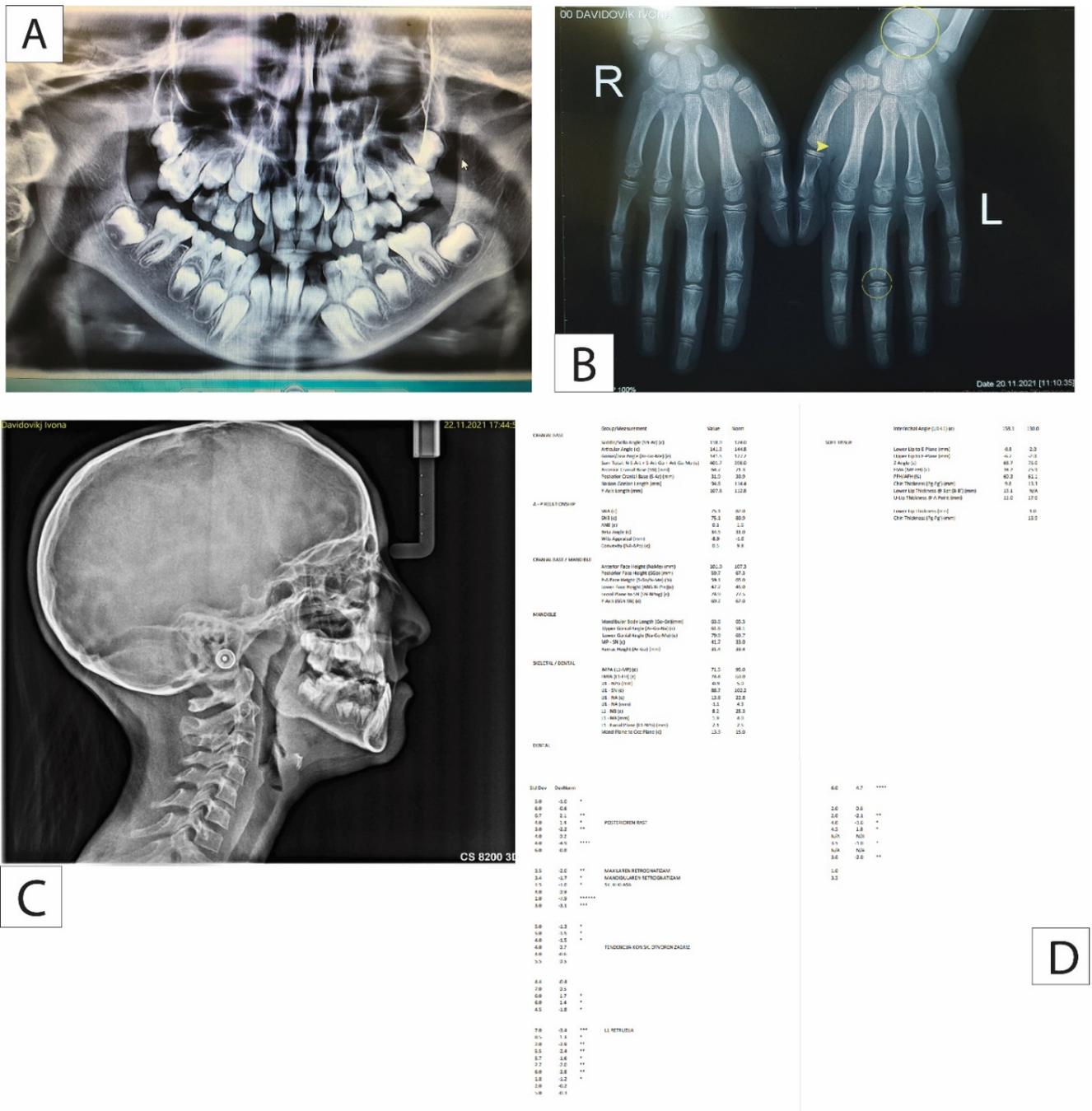


Figure 2.

- A. Orthopantomogram reveals a presence of all permanent teeth with no supernumerary teeth.
- B. Radiograph of the hand and wrist was performed and revealed smaller diaphysis related to the epiphysis. The sesamoid bone is not present yet, and the radius is not fused. Performed comparison with the photo atlas corresponds with the age of a girl between 7-8 years.
- C. The cephalogram shows a vertical growth pattern combined with maxillary retrognathism and mild mandibular retrognathism, skeletal class III with open bite tendency. Dental parameters revealed retroclined lower frontal incisors.
- D. Cephalometric analysis result.

A



B

Figure 3.

A. Extraoral facial features revealed long dolichofacial anatomy with a prominent forehead.

B. Intraoral clinical finding revealed early mixed dentition with permanent upper and lower first molars present. Also, lower permanent central incisors are present. The maxilla is smaller in sagittal, transversal, and vertical planes. Sagittal relation of the upper and lower arch is in Angle Class III and is measured in the canine region.



## Conclusions

The evaluation of orthodontic patients is quite challenging in everyday clinical practice. Usually, except for the clinical diagnosis, additional diagnostic measurements taken are cephalometric analysis and OPG, but this diagnostic protocol usually cannot be a path to comprehensive diagnosis.<sup>13</sup>

Sometimes we need to go deeper and take advantage of more profound measurements and diagnostic tests, revealing even more severe findings. To conclude, it is of immense importance that a differential diagnosis is made. The clinical extraoral and intraoral examination should always be taken with caution in defining the final diagnosis; however, the deeper diagnostic protocol can reveal hidden problems. Further evaluation and follow-ups of the patient's condition are necessary. Genetic examination with a referral from a pediatrician would be of benefit in both cases.

## Declaration of Interest

The authors declare that there is no conflict of interest.

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