



Relationship between Skeletal Class II Malocclusion and Morphology of Sella Turcica in Children Aged 7-10 Years

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Abstract

Objective: The morphology of sella turcica is disturbed if there is a growth disorder in the pituitary gland. The aims of this study were to identify the features of skeletal malocclusion, assess the morphology of sella turcica, and analyze the relationship between skeletal class II malocclusion and the morphology of sella turcica in children aged 7-10 years.

Materials and Methods: This research method is analytic cross-sectional with the research sample in the form of 53 secondary data from digital cephalometric radiographs of pediatric patients aged 7-10 years. Skeletal determination in this study used Steiner analysis and WebCeph™.

Results: The results showed that the average ANB, SNA, and SNB angles were 5.75°, 81.06°, and 75.22°, respectively. Normal morphology of sella turcica was found mostly in this study. According to the phi correlation, the morphological relationship between skeletal class II malocclusion and the morphology of sella turcica in children aged 7-10 years was found to be $p=0.266$.

Conclusion: The most common skeletal class II malocclusion in children aged 7-10 years is mild skeletal class II malocclusion and is caused by the retrognathic position of the mandible to the cranium base. The morphological description of sella turcica in children aged 7-10 years obtained the most normal morphology of sella turcica. There was no relationship between skeletal class II malocclusion and the morphology of sella turcica in children aged 7-10 years.

Keywords: Lateral cephalometry, morphology of sella turcica, skeletal class II malocclusion, steiner analysis, WebCeph™

Introduction

The prevalence of malocclusion and the need for orthodontic treatment is around 80% in Indonesia, which is very high.[1] The results of the study by Hamid and Asad show that skeletal class II malocclusion is the most common occurrence compared with other skeletal malocclusions, with a prevalence of 47%.[2]

Approximately 89% of patients with skeletal class II malocclusion have a mandibular deficiency, mainly due to mandibular hypoplasia and usually manifested as a short chin.[3] Skeletal class II malocclusions were divided into mild, moderate, and severe based on the ANB angle on lateral cephalometry. The results of the research conducted by Bokhari and Asad show that, of patients older than 10 years, 41.7% had mild skeletal class II malocclu-

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sion, 41.7% had moderate skeletal class II malocclusion, and 16.6% had severe skeletal class II malocclusion.[4] Skeletal class II malocclusion was determined by tracing on lateral cephalometry. The mark often used as a reference in lateral cephalometry is the sella turcica.[5] Sella turcica is used as a reference point in lateral cephalometry because this point is considered stable. The growth of sella turcica is complete before the age of 7 years.[6] The sella turcica on lateral cephalometry is a depression in the saddle (U) which is noted as the pituitary fossa, and the pituitary gland is located in that fossa.[5]

Many studies showed that sella turcica and the pituitary gland are related. The developmental stage of the pituitary gland is completed before the sella turcica can form.[7] The morphology of sella turcica will be disturbed if there is a growth disorder in the pituitary gland.[8] The pituitary is a small gland about 1 cm in diameter and weighs 0.5-1 g.[9] In the anterior pituitary gland, there is a hormone associated with growth and skeletal development, called the growth hormone.[10] The hormone causes the release of insulin-like growth factor 1 (IGF-1), which directly affects skeletal muscle and cartilage cells in long bones to increase the absorption of amino acids and their incorporation into new proteins, thereby contributing to linear growth during infancy and childhood.[11]

Significant differences in the morphology of sella turcica were found in individuals of different races in previous studies; therefore, further research is needed to obtain more data and information. The data on the morphology of sella turcica for all communities are required. These data are expected to assist in detecting anatomic abnormalities in sella turcica. Dentists who routinely evaluate lateral cephalometric radiographs by knowing the normal morphology of sella turcica are expected to recognize abnormalities even before seeing the clinical appearance of the patient's malocclusion. Based on this background, the authors conducted research to identify the relationship between skeletal class II malocclusion and the morphology of sella turcica in children aged 7-10 years (Figs. 1, 2).

Materials and Methods

This research method is analytic cross-sectional with the research sample in the form of 53 secondary data of digital cephalometric radiographs of pediatric patients aged 7-10 years. In this study, digital lateral cephalometric radiographs were entered into the Microsoft Office PowerPoint program to assess the quality of the radiographs and test for conformity with the Kappa test. The

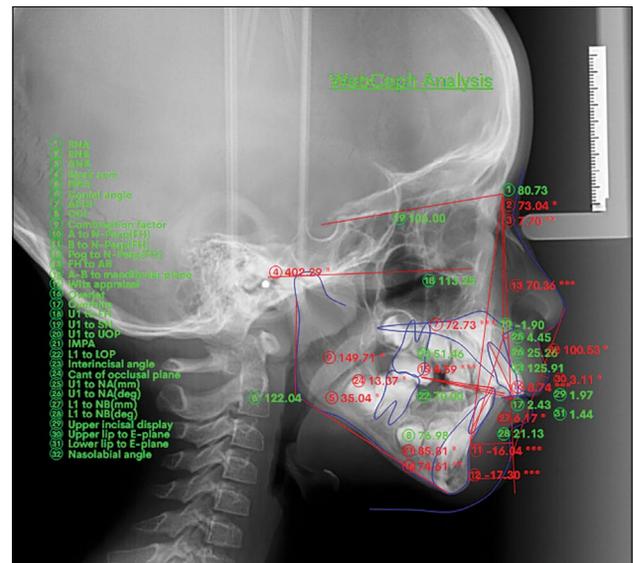


Figure 1. Skeletal class II malocclusion in children aged 7-10 years

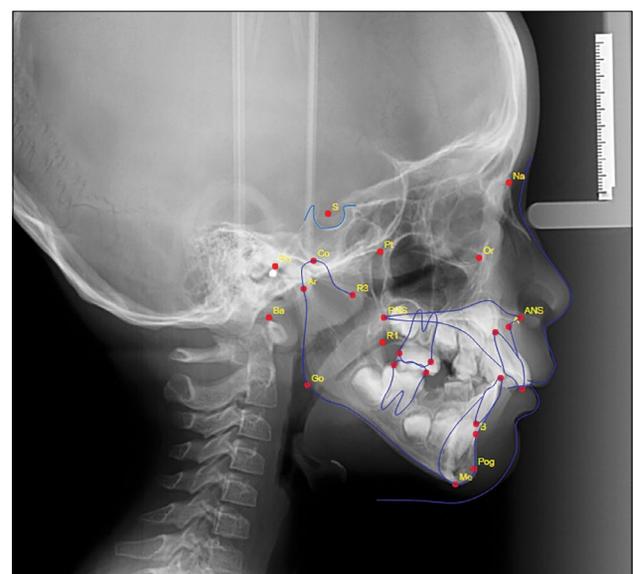


Figure 2. Morphology of sella turcica in children aged 7-10 years

SNA, SNB, and ANB angles were made by the WebCeph™ application (<https://webceph.com>, AssembleCircle Corp., Gyeonggi-do, South Korea), and the conformity test was carried out with the Bland-Altman test. Skeletal classification is determined from Stener's analysis by looking at the ANB angle. An ANB angle $>4^\circ$ indicates a skeletal class II malocclusion. An ANB angle of $4-7^\circ$ is a mild skeletal class II malocclusion, an ANB of $7-9^\circ$ is a moderate skeletal class II malocclusion, and an ANB $>9^\circ$ is a severe skeletal class II malocclusion. According to Axelsson, the morphological variation of sella turcica in skeletal class II malocclusion is determined based on six forms: normal sella turcica, anterior oblique wall, double contour sella turcica, sella turcica bridge, irregularity

(notching) posterior sella turcica, and pyramidal shape of dorsum sella turcica. Determination of the morphology of the sella turcica was recorded, and statistical analysis was performed. This research has obtained ethical approval from the ethics committee of Padjadjaran University with an Ethics Approval Letter number: 07/UN6.KEP/EC/2021 and registration application number: Reg. No.: 0320121317.

Results

Skeletal class II malocclusions were categorized as mild (4°-7°), moderate (7°-9°), and severe (>9°). Mild skeletal class II malocclusions were 86.8%, moderate class II malocclusions were 11.3%, and severe class II malocclusions were 1.9%. The mean ANB angle was 5.75°, and the median was 5.56°, with a range from 4.06° to 9.47°. The SNA angle in skeletal class II malocclusion was obtained on average 81.06°, and the median was 80.94°, with a range from 73.22° to 86.92°. The position of the maxilla to the base of the cranium that was most commonly found was the normal maxilla, which was 43.4%. The SNB angle in skeletal class II malocclusion obtained an average of 75.22°, and the median was 75.31°, with a range of 65.56°-81.02°. The position of the mandible to the base of the cranium that was most commonly found was mandibular retrognathia, which was 86.8%, as shown in Table 1.

According to Axelsson, the morphological description of sella turcica consists of six morphologies, but in research on children aged 7-10 years, only four morphologies of sella turcica were found. The most common morphologies of sella turcica are normal sella turcica (30 samples, 56.6%), pyramidal shape of dorsum sella turcica (12 samples, 22.6%), oblique anterior wall sella turcica (9 samples, 17.0%), and double contour sella turcica (2 samples, 3.8%), as shown in Table 2.

The results of the study on mild skeletal class II malocclusion (4°-7°) obtained 25 samples of normal sella turcica morphology, 7 samples of oblique anterior wall sella turcica, 2 samples of double contour sella turcica, and 12 samples of pyramidal shape of dorsum sella turcica. In moderate skeletal class II malocclusion (7°-9°), 5 samples of normal sella turcica and 1 sample of oblique anterior wall sella turcica morphologies were obtained. In severe skeletal class II malocclusion (>9°), the morphology of the oblique anterior wall sella turcica was obtained in 1 sample. According to the phi correlation, the results of the study obtained $p=0.266$, which showed no relationship between the two ($p>0.05$), as shown in Table 3.

Table 1. Skeletal class II malocclusion examination results in children aged 7-10 years

Morphology of Sella Turcica	Amount	%
Normal Sella turcica	30	56.6
Pyramidal shape of dorsum sella turcica	12	22.6
Oblique anterior wall sella turcica	9	17.0
Double contour sella turcica	2	3.8

Table 2. Results of morphological examination of sella turcica in children aged 7-10 years

Variable	Amount	%
1. Skeletal class II malocclusion		
4°-7° (mild)	46	86.8
7°-9° (moderate)	6	11.3
>9° (severe)	1	1.9
Average (SD): 5.75° (1.30°)		
Median: 5.56°		
Interval: 4.06°-9.47°		
2. SNA angle		
<80° (retrognathic)	19	35.8
80°-84° (normal)	23	43.4
>84° (prognathic)	11	20.8
Average (SD): 81.06° (3.14°)		
Median: 80.94°		
Interval: 73.22°-86.92°		
3. SNB angle		
<78° (retrognathic)	46	86.8
78°-82° (normal)	7	13.2
>82° (prognathic)	0	0
Average (SD): 75.22° (2.9°)		
Median: 75.31°		
Interval: 65.56°-81.02°		

SNA: Sella Turcica, Nasion, A point, SNB: Sella Turcica, Nasion, B point

Discussion

In research conducted by Bokhari and Asad[4] in patients older than 10 years, 41.7% had mild skeletal class II malocclusion, 41.7% had moderate skeletal class II malocclusion, and 16.6% had severe skeletal class II malocclusion. However, in this study, it was found that 86.8% had mild skeletal class II malocclusion, 11.3% had moderate malocclusion, and 1.9% had severe skeletal malocclusion. ANB angles of 4°-7°, 7°-9°, and >9° represent mild, moderate, and severe skeletal class II malocclusion.

The number of etiology of skeletal class II malocclusion is three: maxillary growth to the prognathic cranium but normal anterior mandibular growth; normal maxillary growth to the cranium but less anterior man-

Table 3. Relationship between skeletal class II malocclusion and morphology of sella turcica in children aged 7-10 years

Skeletal class II malocclusion	Morphology of sella turcica								p*
	Normal		Oblique anterior wall		Double contour		Pyramidal shape of dorsum		
	n	%	n	%	n	%	n	%	
4°-7° (mild)	25	83.3	7	77.8	2	100	12	100	0.266
7°-9° (moderate)	5	16.7	1	11.1	0	0	0	0	
>9° (severe)	0	0	1	11.1	0	0	0	0	

*: Phi Correlation=0.380

dibular growth (retrognathic); maxillary growth to the prognathic cranium and less anterior mandibular growth (retrognathic).[12] Research by Ardani et al[13] on Javanese found skeletal class II malocclusion caused by micrognathia mandible. Other research was conducted by Taloumtzi et al[14] In patients aged 8-10 years, it was suggested that skeletal class II malocclusion was due to a prognathic maxilla (25%) and the remainder to a retrognathic mandible (75%). The results of this study are in agreement with the two studies, namely, that the average SNA angle to the cranium base is normal, and the average SNB angle to the cranial base is retrognathic.

The research conducted by Ani[15] in India on the morphology of sella turcica in skeletal class II malocclusion found that 50% of the study subjects had normal sella turcica morphology, then the morphology of the pyramidal shape of dorsum sella turcica (11%), oblique anterior wall (9%), double contour sella turcica (4%), sella turcica bridge (15%), and irregular or notching of the posterior wall (11%). Subsequent research conducted in India with normal patients and craniofacial abnormalities at the age of 8-25 years accompanied by skeletal class II malocclusion found that 51.89% had normal sella turcica morphology and 53.84% had sella turcica bridge morphology.[16] However, the results of another study conducted by Fitriary[17] stated that the normal morphology of the sella turcica in skeletal class II malocclusions was only 16.7%, the sella turcica bridge was 65%, and the irregularity (notching) of the posterior sella turcica was 25%. In the results of this study, only four morphologies of the sella turcica were found: normal sella turcica (56.6%), pyramidal shape of dorsum sella turcica (22.6%), oblique anterior wall sella turcica (17.0%), and double contour sella turcica (3.8%). In the sample of this study, most mild skeletal class II malocclusions were found so that it affected the morphology of the sella turcica. Normal sella turcica morphology is the dominant form.[18] Prenatally, the sella turcica morphology is formed from cartilage, which develops from neural crest cells. It determines the morphology seen postnatally. There is an SHH gene that affects the

formation of the midaxial portion of the cranium that extends from the anterior wall of the sella turcica to the middle. Malformations of the pituitary gland can be a secondary cause of malformations in the sella turcica because the development of the pituitary gland must be completed before the sella turcica can be formed. Deviations in the development of the pituitary gland will result in morphological deviations of the sella turcica. Deviations in the anterior wall seem to be associated with deviations specifically in the frontonasal developmental field, while deviations in the posterior wall are often connected with malformations in the posterior structures (e.g., the cerebellum).[19] The pituitary gland contains growth hormones. Growth hormone deficiency can result in decreased facial bone growth, including maxillary, mandibular, tooth eruption and development, and disproportionate growth of cranial structures, resulting in a retrognathic mandible, lower facial height, and sharp vertical inclination of the mandible.[20]

There is a theory that sella turcica in skeletal class II malocclusion undergoes morphological changes that mostly involve the anterior wall and floor of the sella turcica. This area is embryologically derived from the neural crest, similar to the frontomaxillary complex which this area is strongly connected to and integrated with.[18] Changes that occur in the shape of the sella turcica during growth occur because bone deposition on the anterior part of the interior surface of the sella turcica stops at an early age, whereas resorption in the distal part of the sella floor and the posterior wall continues for a longer period of time. The bone deposition is seen in the tuberculum sellae and resorption at the posterior border of the sella turcica until the age of 16-18 years.[7]

In previous research on the relationship between morphological variations of the sella turcica with skeletal class II malocclusion in patients aged 17-35 years, the results showed that there was a relationship between morphological variations of the sella turcica in patients with skeletal class II malocclusion. A value of $p = 0.266$ indicates there is no statistically strong relationship between skeletal class II malocclusion and sella turcica morphology.

The limitations of this study were due to the limited number of samples on secondary data, and the samples taken consisted of various ethnic groups. The cephalometric analysis and software used to determine the classification of class II malocclusions used only Steiner analysis.

Conclusion

Based on the results of research and discussion on the relationship between skeletal class II malocclusion and the morphology of the sella turcica in children aged 7-10 years, it can be concluded that:

1. The most common feature of skeletal class II malocclusion in children aged 7-10 years is mild skeletal class II malocclusion and is caused by the retrognathic position of the mandible to the base of the cranium.
2. The morphology of the sella turcica in children aged 7-10 years showed the most normal morphology of the sella turcica, which was found in mild skeletal class II malocclusions.
3. There was no relationship between skeletal class II malocclusion and morphology of the sella turcica in children aged 7-10 years.

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Conflict of Interest: None declared.

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