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Research Report

Prevalence of malocclusion and craniofacial morphological variations among 7-13-year-old children in Elementary School, Kediri

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ABSTRACT

Background: Craniofacial morphological variations can influence malocclusion. Mesocephalic head tends to form mesoprosopic face and class I malocclusion. Dolicocephalic head tends to form leptoprosopic face and class II malocclusion. Brachycephalic head tends to form euryprosopic face and class III malocclusion. Emphasizing the importance of malocclusion early treatment, research on malocclusion prevalence and craniofacial morphology variations in growing children is needed. **Purpose:** To determine malocclusion prevalence and craniofacial morphological variations among 7-13-year-old children at Medowo III Elementary School, Kediri. **Methods:** This descriptive study used 44 samples of Medowo III Elementary School, Kediri students. Head and face length and width were measured using a spreading caliper. The cephalic and facial indices were then determined for the classification of head and facial types. **Results:** The dominant craniofacial morphological variations in the samples were hyper-brachycephalic head (39 samples) and euryprosopic face (14 samples). The highest prevalence of malocclusion among individuals with hyper-brachycephalic head type was Angle's class I malocclusion. Class II malocclusion was found in 1 sample, and class III malocclusion in 3 samples. Among the samples with this head type, the most common malocclusion variations were anterior crowding (36 samples), followed by deep bite (15 samples). **Conclusion:** The highest prevalence of malocclusion among Medowo III Elementary School, Kediri students was Angle class I malocclusion, characterized by specific craniofacial morphological variations, namely hyper-brachycephalic head type and euryprosopic face.

Keywords: Malocclusion; craniofacial morphological variations; head type; facial type; medicine

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INTRODUCTION

Malocclusion stands as one of the most significant dental health issues in Indonesia, with a prevalence reaching up to 80% of the population.[1] Unfortunately, access to orthodontic treatment for correcting malocclusion remains limited to a significant portion of the Indonesian population. Medowo Village is among the villages in Indonesia that have poor access to dental health facilities.[2]

The etiology of malocclusion is multifactorial, involving hereditary and environmental factors.[3] These factors can also significantly influence craniofacial growth patterns.[3,4] Craniofacial growth patterns can be identified through craniofacial morphological variations, namely head and facial types. Examining head and facial types before making a diagnosis is crucial, as it enables clinicians to identify craniofacial growth patterns and correlate them with particular malocclusions, ensuring an accurate treatment plan.[5]

Craniofacial morphological variations can influence the development of malocclusion. Mesocephalic head tends to form mesoprosopic face and class I malocclusion. Dolicocephalic head tends to form leptoprosopic face and class II malocclusion. Brachycephalic head tends to form euryprosopic face and class III malocclusion.[6]

Previous studies have shown the prevalence of malocclusion in children, aiming to enhance early diagnosis and treatment. Early diagnosis and treatment are crucial to prevent the development of severe malocclusion in the future.[7] However, there has been limited study on the influence of craniofacial morphological variations on malocclusion development in growing children. Therefore, this article serves as a preliminary study aiming to determine malocclusion prevalence and craniofacial morphology

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variations among 7-13-year-old children at SDN Medowo III Kediri. The data obtained from this research can also serve as a foundation for orthodontic treatment planning for the children at Medowo III Elementary School, Kediri.

MATERIALS AND METHODS

This study utilized an observational descriptive approach with a cross-sectional design. The inclusion criteria for the samples required students who were present at Medowo III Elementary School, Kediri. during the research, aged 7-13-year-old, with all permanent first molars present (not mutilated), never having received orthodontic treatment, having no facial deformity or head defects, no cleft lip or palate, being willing to provide written informed consent and cooperate in data collection, and of Javanese descent for up to two generations. Sampling was then carried out using a total sampling technique that met the inclusion criteria.

The diagnosis of malocclusion was determined through clinical examination conducted by dentists. Malocclusion was recorded based on Angle's classification of malocclusion (class I, II, and III) and its variations, including deep bite, increased overjet (>3 mm), anterior crowding, diastema, open bite, and crossbite. Additionally, intraoral and extraoral images were also taken to confirm the diagnosis.

Head and face dimensions were clinically measured with a spreading caliper (figure 1 and 2). Head length was measured as the distance between the point glabella (g) and opisthocranion (op), while head width represented the transverse diameter between the right and left eurion points (eu).[3] The cephalic index, calculated as the ratio between head width and length multiplied by one hundred, classified head types: ≤ 74.9 as dolichocephalic; 75-79.9 as mesocephalic; 80-84.9 as brachycephalic; and ≥ 85 as hyper-brachycephalic.[6,8]

The facial index was calculated as the ratio between face height and width, multiplied by one hundred. Face height was measured from nasion (n) to gnathion (gn), while face width was determined between the right and left zygion points (zy).[2] The facial index classified facial types: ≤ 85 as euryprosopic; 85-89.9 as mesoprosopic; and ≥ 90 as leptoprosopic.[9]

RESULTS

The total number of samples that met the inclusion criteria was 44 samples. The dominant variation of head type among the samples was hyper-brachycephalic, with a percentage of 88.64% (39 samples). Brachycephalic head type was observed in 4 samples (9.09%), and mesocephalic head type was present in merely 2.27% (1 sample). Within the subset of 39 samples categorized as hyper-brachycephalic head type, 14 samples (35.90%) exhibit euryprosopic facial type, 13 samples (33.33%) demonstrate mesoprosopic facial type, and 12 samples (30.77%) display leptoprosopic facial type.

Table 1 presents the prevalence of malocclusion based on variation of head type. The highest prevalence of malocclusion among individuals with hyper-brachycephalic head type was Angle's class I malocclusion. Class II malocclusion was found in 1 sample, and class III malocclusion in 3 samples. Among the samples with this head type, the most common malocclusion variations were anterior crowding (36 samples), followed by deep bite (15 samples), anterior crossbite (9 samples), diastema (7 samples), increased overjet (> 3 mm) (6 samples), anterior open bite (3 samples), and posterior crossbite (3 samples).

DISCUSSION

The dominant head type variation found in the sample was hyper-brachycephalic. This study's findings correspond with previous research on Malay and Chinese ethnic samples in Malaysia, indicating a propensity towards hyper-brachycephalic head types.[10,11] The consistency between the current and previous studies may be attributed to both Javanese and Malaysian populations originating from the same race, the Mongoloid. Furthermore, this research's outcomes align with a previous study on 7-18-year-old students at Namira Islamic International School Medan, who were descendants of the Deutro Malay race for up to two generations. In that study, 80% of the samples exhibited hyper-brachycephalic head types. These similar findings are due to the fact that all students at Medowo III Elementary School, Kediri are Javanese and belong to the larger Deutro Malay subrace, resulting in similar head type characteristics.[12]

Out of 39 samples with hyper-brachycephalic head types, the most prevalent facial types observed was euryprosopic. This high prevalence suggests that individuals with hyper-brachycephalic head types tend to have broader and shorter faces. These findings correspond with Enlow & McNamara's theory on craniofacial growth.[13] Individuals with a hyper-brachycepahlic head shape possess a wide and rounded brain, along with a short and angulated cranial base,

Table 1. Prevalence of head type variations and angle's classification of malocclusion

Head Type	Frequency	Angle's Classification of Malocclusion		
		Class I	Class II	Class III
Dolicocephalic	0	0	0	0
Mesocephalic	1	1	0	0
Brachycephalic	4	3	1	0
Hyper-brachycephalic	39	35	1	3
Total	44	39	2	3

resulting in relative retrusion of the nasomaxillary complex and anterior rotation of the mandible. Consequently, these individuals exhibit a broader and shorter face, known as euryprosopic face.[6]

The difference in the number of samples with euryprosopic facial type and other facial types, however, is not substantial. This could be due to the continuous growth in facial width and height until the age of 16, leading to potential changes in the determined facial type in growing samples.[14] Furthermore, facial type can be influenced by various factors, including genetics and nutrition. Genetic factors play a role in shaping facial bones and determining maxillary and mandibular symphysis height. Nutritional factors are associated with the diet consumed. A diet consisting of harder foods may result in a more robust bone structure compared to softer foods, which causes a decrease in pressure to stimulate the growth and development of the mandible and maxilla.[15]

Based on previous research, hyper-brachycephalic head type can be associated with class III malocclusion.[6] However, in this study, out of 39 samples with hyper-brachycephalic head types, 35 samples exhibited Class I malocclusion. Class III Angle malocclusion was found in only 3 samples. Anterior crossbite, a characteristic of Class III malocclusion, was observed in only 9 samples. Based on the worldwide prevalence study of malocclusion, Class III malocclusion observed in the mixed dentition phase has the highest prevalence among Mongoloid races compared to other races (Caucasoid and Negroid). In the Mongoloid races, 15-23% of individuals exhibit class III malocclusion. On the other hand, the prevalence of class III malocclusion in Caucasoid and Negroid races is lower, ranging from 1-5%.[16] The current study utilized fewer samples. Hence, the prevalence of malocclusion does not necessarily represent the entire Javanese population. Furthermore, malocclusion is a multifactorial disorder influenced by numerous factors beyond head and facial type variations. Therefore, hyper-brachycephalic heads do not invariably lead to class III malocclusion.

In samples with hyper-brachycephalic head types, there was a high prevalence of anterior crowding. These findings contradict the study by Shung et al.[8] which found a greater tendency for dolichocephalic head types to cause anterior crowding compared to other head types. Individuals with dolichocephalic head types tend to have narrow dental arches, resulting in insufficient space for ideal tooth eruption. On the other hand, individuals with hyper-brachycephalic head type tend to form a wider dental arch, resulting in a lower prevalence of anterior crowding.[8] The high prevalence of anterior crowding in the current study may be caused by premature loss of primary anterior teeth due to caries, which leads to teeth migration and shortens the arch length for the eruption of permanent teeth.[17,18] Due to its location on remote mountain slopes, access to dental healthcare for Medowo Villagers is still limited.

The high prevalence of deep bites in the samples with hyper-brachycephalic head type may be associated with the mixed dentition phase. The mandibular permanent teeth tend to erupt before the maxillary permanent teeth. This difference in eruption time can cause the supra-eruption of lower incisors, leading to deep bite and an increased curve of Spee. In the permanent dentition phase, the curve of Spee reduces and becomes relatively stable due to the full eruption of premolars and second molars.[19] Apart from the normal increase in the curve of Spee during mixed dentition phase, deep bite may also be related to hyper-brachycephalic head type. Individuals with hyper-brachycephalic heads have a shorter mandibular corpus. To compensate for this, there is an increase in the curve of Spee with supra eruption of the mandibular incisors, infra-eruption of premolars, and mesial version of mandibular molars. [19] In addition, individuals with a hyper-brachycephalic head type also have a tendency towards anterior and superior rotation of the mandible, leading to deep bite.

This study has several limitations. Firstly, the small sample size used may not be sufficient to represent the entire Javanese population. Secondly, the current study did not measure the arch dimensions from study models. The tendency of certain head types to form certain dental arch forms was solely based on previous research, which might not necessarily match the characteristics of this study's sample. Thirdly, apart from head types, the high prevalence of deep bites in the sample could also be attributed to the normal increase in the curve of Spee during the mixed dentition phase. Therefore, further research with cohort design (longitudinal study) is needed to observe whether the occurrence of deep bite is due to head type variations or differences in eruption time of mandibular and maxillary teeth.

Within the limitations of this study, we conclude that the highest prevalence of malocclusion among Medowo III Elementary School, Kediri students was Angle class I malocclusion, characterized by specific craniofacial morphological variations, namely hyper-brachycephalic head type and euryprosopic face.

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