

Malocclusion and orthodontic treatment need in Phu Mau and Vinh Ninh primary school children, Thua Thien Hue province

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Abstract

Malocclusion is a common dental health problem and can affect the health and life of people. The assessment of malocclusion helps to determine the need for orthodontic treatment according to the two components of dental health and dental aesthetics, which is very important to help improve the effectiveness of intervention and prevention methods necessary. **Objectives:** To determine the prevalence of malocclusion of primary school students, to determine the need for orthodontic treatment of primary school students according to the index of needs for orthodontic treatment, and the relationship with malocclusion. **Method:** A cross-sectional descriptive study on 220 primary school students aged 7 - 9 at two primary schools in Thua Thien Hue province from June 2021 to September 2021. Conduct oral examination, collect information, measure, observe and record indicators of malocclusion and orthodontic needs. **Results:** The results of the study on 220 students showed that the ratio of molars in the Angle I direction was the highest, accounting for 45%, and malocclusion was quite high (79.09%). Regarding the need for orthodontic treatment, according to DHC-IOTN, 39.55% had little treatment and according to AC-IOTN, 36.6% had moderate treatment. There is a strong correlation between malocclusion status and DHC-IOTN ($r=0.65$, $p>0.05$), malocclusion and AC-IOTN have an average correlation ($r=0.44$, $p>0.05$). There is also a strong correlation between AC-IOTN and DHC-IOTN ($r=0.60$, $p>0.05$). There was no gender difference between treatment levels for dental health and dental aesthetics with $p>0.05$. **Conclusions:** malocclusion in 7-9 years old students is quite high - the need for orthodontic treatment according to both dental health components, and aesthetics dentistry. It is necessary to provide timely and effective interventions to improve the oral health of children.

Keywords: Malocclusion, IOTN, need for orthodontic treatment, children.

1. INTRODUCTION

Malocclusion is a common dental health problem and can affect the health and life of people through occlusal trauma, reduced chewing function, creating favorable conditions for the development of oral diseases, and affecting facial aesthetics, pronunciation, and psychological problems [1]. The rate of malocclusion at all ages according to studies in the world: Colombia (2001) [2] is 88% at the age of 5-17, Brazil (2011) [3] is 73% at the age of 7-12. In recent years, orthodontic treatment is gaining popularity, as a consequence of patients' expectations regarding the oral impact on the quality of life and treatment opportunities. Orthodontic treatment is necessary to improve dental health - reduce the risk of tooth decay and gum disease, function, and appearance.

The orthodontic treatment need is not only a matter of identifying malocclusion but also relying on specific tools/indicators to properly assess orthodontic treatment needs [2]. The index of orthodontic treatment need (IOTN) has two components: dental health component (DHC) and aesthetic component (AC). It is practical and will help to identify the

misalignment of molars, and conducting early intervention will contribute to improving treatment efficiency and minimizing unwanted deviations in the future, especially at the age of 7 to 9 years. At this age, the first permanent molars of the upper and lower jaws begin to articulate to form a collaborative relationship between the dental arches.

A study by Nesreen A Salim et al. (2021) on malocclusion in children and assessment of orthodontic treatment needs among Syrian refugee children and adolescents showed that the prevalence of malocclusion was 83.8% (52.6% class I, 24.2% class II, 7% class III) [4]. The prevalence of moderate to severe need for orthodontic treatment was 67.7%. A study by Cao Minh Nha Uyen et al. (2018) among 12-year-old children living in Ho Chi Minh City in 2019 showed that 42% of the subjects were diagnosed with severe malocclusion that needed orthodontic treatment according to DHC-IOTN and 33.6% according to AC-IOTN [5]. However, related studies are still limited and until now, Thua Thien Hue province has not had any research on the status of molar misalignment and the need for orthodontic treatment at this age.

Realizing the importance of identifying the status of molar misalignment for early intervention for children and the need for orthodontic treatment at this age. Therefore, we have studied this topic with the objectives of determining the prevalence of malocclusion of primary school students, determining the need for orthodontic treatment of primary school students according to the index of orthodontic treatment needs, and the relationship with malocclusion

2. METHODS

The study sample includes 220 children (111 males and 109 females) in the age group of 7-9 years randomly selected from Phu Mau and Vinh Ninh primary schools in Thua Thien Hue province from 06/2021 to 09/2021. The individuals had no history of orthodontic treatment. A minimum sample size consisting of 214 individuals was calculated with a margin of error of 5% and a 95% confidence level.

Based on statistics of the Department of Education and Training of Thua Thien Hue province on the distribution of primary schools in communes and wards. The province consists of 216 primary schools. The sample frame consists of two floors: urban and rural. The sample size for each floor is 110 students/floor. Randomly select two schools (one in urban and one in rural). At each school, randomly select students according to the class list of grades 2, 3 and 4 until the number is full. An oral examination was conducted by two examiners after obtaining consent from the parents.

Evaluation of dental health components according to DHC-IOTN

The DHC [Table 1] of the IOTN has five categories ranging from 1 (no treatment required) to 5 (treatment required). The most severe occlusal trait is identified for any particular patient and the patient is then categorized according to this most severe trait.

Table 1. The Dental Health Component of the index of orthodontic treatment needs

Dental health level	Occlusion characteristics
Grade 1 : No treatment required	Normal bite or very mild malocclusion including tooth position deviation less than 1 mm.
Grade 2: Little treatment required	+ 2a: Overjet > 3.5 mm and ≤ 6 mm (competent lips) + 2b: Reverse overjet > 0 and ≤ 1 mm + 2c: Cross bite anterior/posterior where there is a distance between the posterior contact position and the central occlusion position 1 mm + 2d: Displaced contact points > 1 mm and ≤ 2 mm + 2e: Open bite anterior/posterior > 1 mm and ≤ 2 mm + 2f: Overbite ≥ 3.5 mm (No gingival contact) + 2g: Pre- or post-normal occlusion no other anomalies present.
Grade 3: Moderate treatment required	+ 3a: Overjet > 3.5 mm and ≤ 6 mm (Incompetent) + 3b: Reverse overjet > 1 mm and ≤ 3.5 mm + 3c: Cross bite anterior/posterior where the distance between the posterior contact position and the central occlusal position is > 1 mm and 2 mm. + 3d: Displaced contact points > 2 mm and ≤ 4 mm + 3e: Open bite anterior/posterior > 2 mm and ≤ 4 mm + 3f: Overbite complete gingiva or palate no trauma.
Grade 4: Severe/ Treatment required	+ 4a: Overjet > 6 mm and ≤ 9 mm + 4b: Reverse overjet > 3.5 mm but no + 4c: Cross bite anterior/posterior where the distance between the posterior contact position and the central occlusal position is > 2 mm. + 4d: Displaced contact points > 4 mm. + 4e: Open bite anterior/posterior severe > 4 mm. + 4f: Overbite and complete with trauma gingiva or palate. + 4h: Less extensive hypodontia requiring prerestorative orthodontics or orthodontic space closure to obviate necessity for prosthesis. + 4l: Posterior crossbite without functional occlusal contact of one or more buccal segments. + 4m: Anterior or posterior crossbites with a distance between the posterior contact position and the central occlusion position > 2 mm. + 4t: Partially erupted, tipped, and impacted against adjacent teeth. + 4x: Presence of supernumerary teeth.

Grade 5: Very severe/Treatment required	+ 5a: Overjet > 9 mm. + 5h: Extensive hypodontia with restorative implications (> 1 tooth missing in any quadrant) requiring preresorative orthodontics. + 5i: Impeded eruption of teeth except third molars due to crowding, displacement, the presence of supernumerary teeth, retained deciduous teeth, and any pathological cause. + 5m: Overbite > 3.5mm and recorded effects on chewing, pronunciation. + 5p: Cleft lip/palate craniofacial anomalies. + 5s: Sunmerged deciduous teeth.
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Assessment of dental aesthetics according to AC-IOTN.

Based on 10 standard images of Brook and Shaw (1989) [1]. Assess the esthetic arrangement of teeth or not.

The AC [Figure 1] of the IOTN includes a 10-point scale illustrated by a series of photographs representing various range of esthetics, Grade 1 representing most aesthetic and Grade 10 least aesthetic arrangement of the dentition. A rating is allocated for overall dental aesthetics rather than specific similarities to the photographs.

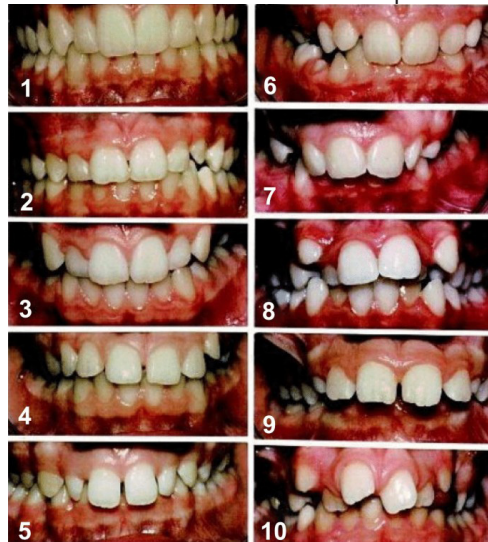


Figure 1. Index of orthodontic treatment need: Aesthetic component

Grade 1-2: No treatment required

Grade 5-7: moderate treatment required

Grade 3-4: little treatment required

Grade 8-10: treatment required

Statistical Methods

The data were collected and cleaned using Excel software, then SPSS software (version 20.0) was used to process and manage data. The results are described by tables, percentage charts. Chi-square test was used to evaluate the relationship between two qualitative variables. Pearson correlation survey to evaluate each relationship between malocclusion and the need for orthodontic treatment with two components: dental aesthetics and dental health.

3. RESULTS

The present study was carried out to evaluate malocclusion among Thua Thien Hue schoolchildren in the 7 - 9 years age groups. Among the 220 children examined for the prevalence of malocclusion, 50.5% were boys and 49.5% were girls. There were a total

of 46 children (20.91%) with normal occlusion, 99 children (45%) of molars in the anterior to posterior direction Grade I. These results of the study correspond to the findings of other studies.

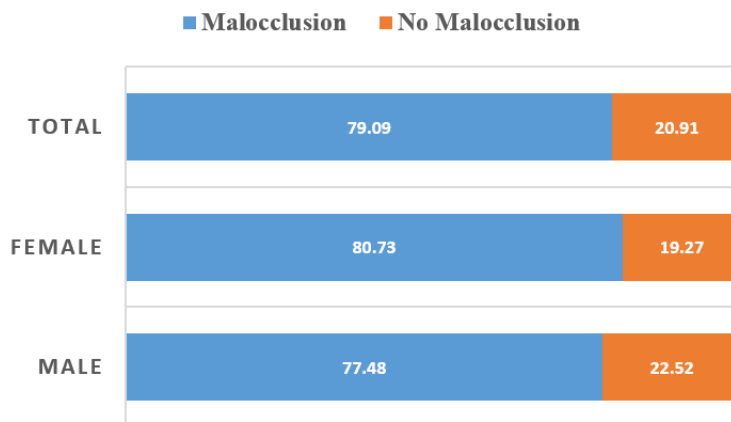
3.1. Malocclusion status

Among 220 students, the ratio of molars in the anterior to posterior direction, Grade I, was the highest, accounting for 45%, and the unclassified Angle class had the lowest rate of 7.73%. The vast majority of students had a normal overjet of 0 - 4 mm (82.73%), 6.36% of students had an overjet > 4 mm and 10.91% had an anterior cross bite. Of children with a negative overbite (overbite <0mm) had the lowest rate of 2.73%, 11.82% of students had an overbite > 4 mm, and the normal overbite highest is 85.45%.

Table 2. Prevalence of occlusal characteristics in children 7-9 years old by gender in Thua Thien Hue province (N = 220)

Occlusion straits	Male	Female	Total
Angle			
Angle I	37.84	52.29	45
Angle II	21.62	13.76	17.73
Angle III	13.51	12.84	13.18
Cannot be graded	11.71	3.67	7.73
Unsymmetrical	15.32	17.43	16.36
Horizontal relationship			
Overjet < 0 mm	9.91	11.93	10.91
Overjet 0 - 4 mm	80.18	85.32	82.73
Overjet > 4 mm	9.91	2.75	6.36
Vertical relationship			
Overbite < 0 mm	1.8	3.67	2.73
Overbite 0 - 4 mm	83.78	87.16	85.45
Overbite > 4 mm	14.41	9.17	11.82
Displaced contact points 0 - 2 mm	72.97	61.47	67.27
Displaced contact points 2 - 4 mm	18.02	26.61	22.27
Displaced contact points > 4 mm	9.01	11.93	10.45

Most of the students had a tooth position deviation of no more than 2 mm (67.27%), a serious tooth position deviation of > 4 mm, accounting for 10.45%. Malocclusion accounted for a relatively high rate (79.09%), the rate of malocclusion of female accounted for 50.6% higher than that of male was 49.4%. There was no difference in the rate of malocclusion by gender with $p > 0.05$.

**Graph 1.** Prevalence of malocclusion by gender (%)

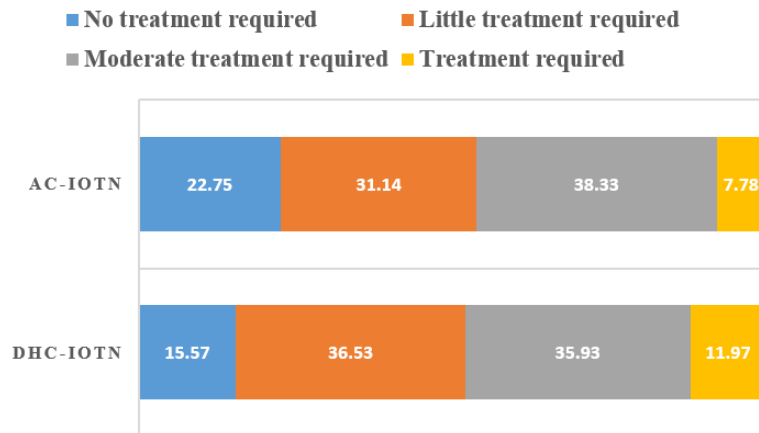
3.2. The orthodontic treatment need

The results in table 3 show that, about DHC-IOTN: 33 (15%) students have no treatment required, 87 (39.55%) students have little treatment required, and 73 (33.18%) students are in the moderate treatment required, 27 (12.27%) students are in the category of very treatment required. And AC-IOTN, 53 (24.09%) students are classified as having no treatment required, 68 (30.91%) with little treatment required, 80 (36.6%) students with moderate treatment required, and 19 (8.6%) in the very treatment required. Regarding the relationship between Angle bite and DHC-IOTN and AC-IOTN indexes (graph 2), the majority of students are mostly at a little treatment

required (36.53% of DHC-IOTN) and moderate treatment required 38.32% of AC-IOTN), and treatment required for a low percentage. There is a difference in the degree of need for orthodontic treatment according to the Angle occlusion classification with $p < 0.05$.

Table 3. Demand for orthodontic treatment according to dental health component (DHC-IOTN) and dental aesthetic component (AC-IOTN) by gender

		Gender	Male	Female	Total	p
Orthodontic treatment need			%	%	%	
DHC-IOTN	No treatment required (grade 1)		18.02	11.93	15	0.651
	Little treatment required (grade 2)		38.74	40.37	39.55	
	Moderate treatment required (grade 3)		31.53	34.68	33.18	
	Treatment required (grade 4,5)		11.71	12.84	12.27	
	Total		100	100	100	
AC-IOTN	No treatment required (image 1,2)		22.52	25.69	24.09	0.92
	Little treatment required (image 3,4)		29.73	32.11	30.91	
	Moderate treatment required (image 5,7)		37.84	34.86	36.4	
	Treatment required (image 8,10)		9.91	7.34	8.6	
	Total		100	100	100	



Graph 2. Relationship between Angle bite and DHC-IOTN and AC-IOTN

3.3. Correlation

Malocclusion and the need for dental health treatment are strongly correlated with $r = 0.65$, malocclusion and the need for cosmetic dental treatment has an average correlation with $r = 0.44$, the orthodontic treatment needs of health component and aesthetics component have a strongly correlation with $r = 0.60$.

Table 4. The correlation between the need for orthodontic treatment according to the orthodontic treatment demand index (IOTN) and malocclusion

	DHC-IOTN	AC-IOTN	Displaced contact points	p
DHC-IOTN	1	0.60	0.65	0.000
AC-IOTN	0.60	1	0.44	
Displaced contact points	0.65	0.44	1	

4. DISSCUSION

A cross-sectional study on 220 primary school students aged 7 to 9 on malocclusion characteristics, IOTN index of dental health, and esthetic components, thereby determining the need for orthodontic treatment, and facial features of children in some primary schools in Thua Thien Hue province.

The study shows that: The correlation of molars in Angle I is the highest at 45%, and the lowest is a type other than Angle unidentified with 7.73%. Most subjects had normal overbite (82.73%), normal overbite coverage 85.45%, and tooth position deviation >2mm accounted for 32.72%. The rate of malocclusion is 79.09%. There was no gender difference in malocclusion as well as individual occlusal characteristics with $p < 0.05$.

According to the research results, among 220 students, the ratio of premolar correlation in the anterior to posterior direction of Grade I is the highest, accounting for 45%, and the rate of non-Angle classification that cannot be classified has the lowest rate of 7.73% (graph 1). This result is study had a lower rate than Al-Khalifa KS et al. (2021), with an Angle I correlation of 78.2%[6].

The results showed that the percentage of students with normal overjet was the highest (82.73%), and the lowest rate of overjet was 6.36%. Compared with the study of Perillo L et al. (2009) [7], the normal overbite, the anterior crossbite, and the increased overbite were 83.4%, 0.6%, and 16.2%. In the normal overbite ratio, there was a difference in the overbite and reverse overjet rates.

For the vertical relationship of anterior teeth, the majority of students had a normal overbite at 85.45%, and the rate of open bite was the lowest at 2.73% (table 1). The study of Perillo L et al. (2009) [7], although not completely similar, is quite close to my research results with a normal overbite, and the open bite is 79.09% and 0.7%. The study by Grippaudo M et al. (2020) had a higher rate of open bite with 23% [8].

The results in table 1 show that the rate of tooth position deviation >2mm of students in my study is 32.72%. The most common cause of tooth misalignment is a lack of space for teething. The lack of space may be due to the change in jaw bone size that is not suitable for the change in tooth size and number [9], the size of the replacement permanent teeth is larger than that of the primary teeth, and lateral caries reduces the proximal size. In the distal of the baby teeth, the early loss of milk teeth causes the adjacent teeth to tilt, moving into the space where the missing teeth are.

The research results showed that malocclusion in students accounted for a relatively high rate of 79.09% (Graph 1). Our study results are similar to those of Fes-ta P et al. (2021), which is 81.4%[10]. However, this result is higher than the study of Patil Disha et al. (2017) with 40.9% [11]. The difference in this rate may be due to the difference in ethnic groups but also depends on the sample size and age of the studies.

In general, the orthodontic treatment needs are mainly mild/little and require moderate treatment. In orthodontic treatment according to the tooth health component, the rate of mild need/little need for treatment is 39.55%, and 15% no treatment. In orthodontic treatment according to aesthetic composition, the moderate treatment required is the highest, accounting for 36.6% and 24.09% without treatment. There was no gender difference between treatment levels for the health component and aesthetics component with $p > 0.05$.

The results of the study in Table 3.4 show that the percentage of students with the need for orthodontic treatment is increasing, of which little treatment accounts for the highest proportion at 39.55% and treatment required for the lowest at 12.27%. The results of my study are quite similar to a study by Cao Minh Nha Uyen et al. (2019) showed that 42% of the subjects were diagnosed with severe malocclusion that needed orthodontic treatment according to DHC-IOTN.

With the need for orthodontic treatment according to the dental aesthetic component, moderate treatment required is the highest, accounting for 38.33%, and 7.78% treatment required, accounting for the lowest rate. The results of our higher study by Cao Minh Nha Uyen et al. (2019) showed that 33.6% of the subjects were diagnosed with severe malocclusion that needed orthodontic treatment according to AC-IOTN [5] but different from studies by Janošević P et al (2015) had no treatment need is the highest proportion at (60.4%) [12]. This difference may be due to differences in race or age.

In terms of correlation, the need for treatment according to the components of dental health and dental aesthetics has a strong correlation with $r = 0.60$. Research by Soames Mourad (2006) [13] in France shows that there is a strong correlation between the two components with $r = 0.76$.

The relationship between the need for orthodontic treatment (IOTN) and malocclusion is a statistically significant relationship between the orthodontic treatment needs in terms of health component and aesthetics component and the malocclusion of students with $p < 0.05$. At the same time, there is also

a relationship between the orthodontic treatment needs between the two components of dental health and dental aesthetics with $r=0.60$.

In the study sample, there were 26 students (15.6%) who did not need orthodontic treatment according to the health component and all belonged to Angle I occlusion type, which is cases with occlusal correlation Angle II, and III both need treatment. There is a significant difference in the need for orthodontic treatment according to dental health components according to Angle occlusion classification with $p<0.05$.

The above research results show that the orthodontic treatment needs according to both health component and aesthetic components related to Angle occlusion correlation or more broadly related to malocclusion. Malocclusion has a strong correlation with the need for health component treatment with $r=0.65$ and an average correlation with the need for aesthetic components with $r=0.44$.

We can see that both components of the orthodontic treatment demand index are correlated with malocclusion, but the tooth health component is correlated much more closely with the aesthetics com-

ponent. It is understandable because the need for orthodontic treatment in terms of dental health is determined based on malocclusion characteristics: Angle bites correlation, malocclusion, crossbite, reverse overjet, and overbite. While the need for orthodontic treatment in terms of cosmetic dentistry only evaluates the aesthetic aspects of the occlusion viewed from the front, it is mainly related to abnormalities in the anterior teeth such as overbites, overbites, and gaps between teeth.

5. CONCLUSION

While there is an increased prevalence of malocclusion among children in the 7-9 years age group, the orthodontic treatment needs are mainly mild/little and require moderate treatment. There is a statistically significant relationship between the orthodontic treatment needs in terms of health component and aesthetics component and malocclusion. The finding of this study will provide baseline data for implementing early interceptive treatment for the elimination of factors inhibiting dental arch development as well as skeletal.

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