

The prevalence of malocclusion, dental irregularities and orthodontic treatment need in 13-15 year olds in Teuk Klaing, Cambodia.

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Abstract:

Objectives: The objective of this study was to assess the prevalence of malocclusion in a sample of adolescents in the Kandal Province, in Cambodia. The prevalence of malocclusion and orthodontic treatment needs in this group is unknown, and oral health is not a priority compared to other health problems.
Design: This was a cross sectional study design.
Setting and participants: The participants in this study constituted of 61 13-15 year old adolescents from the Teuk Klaing commune.
Methods: Clinical oral examinations were conducted using portable dental equipment. The basic method for recording occlusal traits which was developed by the World Health Organisation (WHO) and Federation Dentaire International (FDI) was used to record the occlusal traits of each participant. If the traits present predisposed the participants to increased risk of tooth loss (caries, periodontal disease, and trauma or root resorption), physiological disturbances of function (disorders of the temporo-mandibular joint, speech defects, or masticatory disturbances) or socio-psychological disturbances, this was considered to be an indicator for orthodontic treatment. The indications for

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orthodontic treatment needs were according to the Bezroukov guidelines. Results: The prevalence of missing first molars was high (3.6% to 14.3%). Crowding of 4mm or more in incisal segments were also high (32.1% to 48.5%). Bilateral class II molar occlusion of a half unit was recorded in 10.7% of females and 9.1% of males, whereas bilateral class III molar occlusion of a half unit was recorded in 17.9% of girls and 3.0% of boys. The frequency of overjet (8.1%), crossbite (14.7%), overbite (26.2%), openbite (16.4%) and midline shift (70.5%) were also recorded in this study. Orthodontic treatment needs indicated that 50% of females and 39.4% of males needed orthodontic treatment.

Conclusion: These outcomes indicate a high prevalence of the above mentioned occlusal traits, and also a high need for orthodontic treatment among adolescents in the Teuk Klaing commune.

Keywords: Orthodontics, Pediatric dentistry, Dental health promotion

Introduction:

The Kingdom of Cambodia is a developing country with a total area of 180,000 km² and lies entirely within the tropics. The National Census of 2008 reported that Cambodia has a population of 13.4 million, and a per capita gross national income of US\$430 (2005). More than 90% of its population is of Khmer origin and the remainder includes Chinese, Vietnamese, Cham and Khmer Ethnic. More than 80% of the population live in rural areas and are engaged mainly in subsistence agriculture. Approximately 35 per cent of the population live below the poverty line of US\$0.59 per day. Economic growth has averaged 8% per annum in the last decade. The structure of the economy is slowly changing, with gradually increasing industrialization, and foreign aid makes a major contribution.¹

Data from the 2005 Cambodia Demographic and Health Survey indicate that major improvements in health status have

occurred in recent years, most particularly a sharp decline in childhood mortality rates: life expectancy is increasing (57 years for males and 64 years for females) and the under-5 mortality rate fell by 40 per cent from 1998 to 2003. The gains in health status have not been distributed equally. To finance their health costs, 80% of Cambodians use savings, go into debt or sell assets, and only 16% are able to pay health costs from regular income.²

Between 1975 and 1979 Cambodia suffered a massive destruction of its social structures under the Khmer Rouge. The dental profession was almost annihilated and the dental school in Phnom Penh stripped bare.³ The ratio of dentists to the population is still pitifully low and public services are concentrated in Phnom Penh and in provincial towns. Traditional dentists provide the only accessible dental care in many places.⁴ A primary oral health care system has yet to be developed. Under the Khmer Rouge, education facilities, resources and staff were scarce and they continue to be underdeveloped to this day. Cambodia's public oral health services are concentrated in Phnom Penh and in provincial towns but not in smaller towns or rural areas.⁴ The ratio of dentists to the general population remains low; with almost two dentists per 100 000 people in Cambodia.⁵ Recently, many private dental clinics have opened in Phnom Penh, due to the increased demand over the last decade because of the improving economy. While traditional dentists provide dental care in many places, their practice is of poor quality compared with Western standards.⁴

The Cambodia National Oral Health Survey (1991) revealed that most people have some form of preventable, easily treated, often painful oral diseases, especially among children (more than 90%).⁶ Rural resources, both curative and preventive, are extremely limited, which perpetuates these chronic conditions.⁶

Currently oral health, and in particular the treatment of malocclusion, is not a high priority in Cambodia. However, for future

planning purposes, valid and reliable information regarding treatment needs for various oral conditions and diseases in Cambodia are needed. There are no previous research data on orthodontic treatment needs or the prevalence of malocclusion in the Cambodian population. In other parts of the world, the prevalence of malocclusion varies widely among different populations and countries, in part because there is no agreement among investigators on the concept of how much deviation from the ideal should be accepted within the bounds of normal. Another problem is that the terminology that is used to define the traits of malocclusion differs, as does study methodology. The aim of this survey was to assess the prevalence of malocclusion and dental irregularities in a sample of 13-15 year old adolescents in the Teuk Klang commune, Kandal province, in Cambodia, as well as their orthodontic treatment needs.

Material and Method:

Ethics approval was obtained from the National Ethics Committee for Health Research of the Ministry of Health, Cambodia. Permission was sought from the school authorities prior to examination and consent forms were distributed to the parents or guardians of the selection children prior to examination.

Study population

This was a cross sectional survey assessing the occlusal traits of the sample population in the Kandal province of Cambodia. The Kandal province has a total area of 3,500 square kilometres with a population of 1.3 million. Teuk Klaing is a commune in Kandal province, and this is where the survey was conducted.

This was a convenience sample and a sample size estimation was not done. All children from two high schools in Teuk Klaing commune were invited to participate and were examined by qualified examiners. A total of 61 children took part, equating to 17.4% of the total 350 school children in the commune. The

participants were aged between 13 and 15 years (at their last birthday). Inclusion criteria: all those invited who had consent to take part. Exclusion criteria: Prospective participants who had prior orthodontic treatment were excluded from the study.

Clinical examination:

All clinical examinations were completed at the schools, using portable dental chairs with natural lighting, and using mouth mirrors and probes. The basic method for recording occlusal traits which was developed by the World Health Organisation (WHO) and Federation Dentaire Internationale (FDI) was used to record the occlusal traits of each participant.⁷ This method was chosen as it provides investigators and health authorities with a common basis for assessing the prevalence of malocclusion in various parts of the world.

If the traits present predisposed the participants to increased risk of tooth loss (caries, periodontal disease, and trauma or root resorption), physiological disturbances of function (disorders of the temporo-mandibular joint, speech defects, or masticatory disturbances) or socio-psychological disturbances, this was considered to be an indicator for orthodontic treatment. The indications for orthodontic treatment needs were according to the Bezroukov guidelines.⁷ This method was chosen as it is widely used and serves as a basic reference tool in the development of methods for assessing the need and demand for orthodontic treatment.

Examiner calibration:

A pilot study to calibrate examiners was completed with twenty 13 to 15 year olds at a primary school in Teuk Klaing's commune. To determine the reliability, all 20 participants were examined by the first examiner and these participants were then re-examined by a second examiner. This process was repeated one week after the initial examination. The data from a first experienced examiner was used as a gold standard. The kappa values for intra-examiner

Figure 1a: Distribution(%) of missing maxillary teeth by gender, according to tooth number.

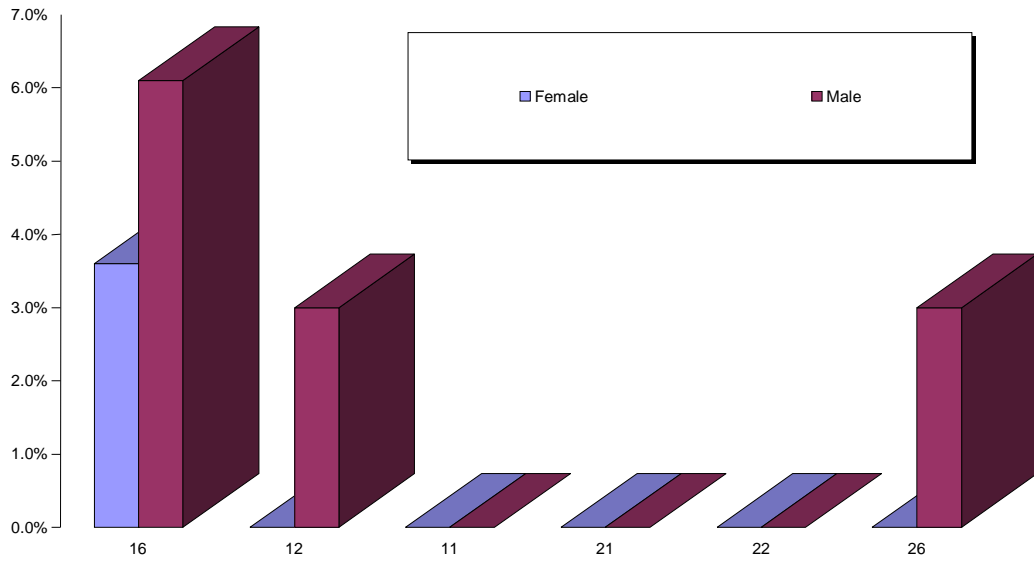


Figure 1b. Distribution(%) of missing mandibular teeth by gender, according to tooth number

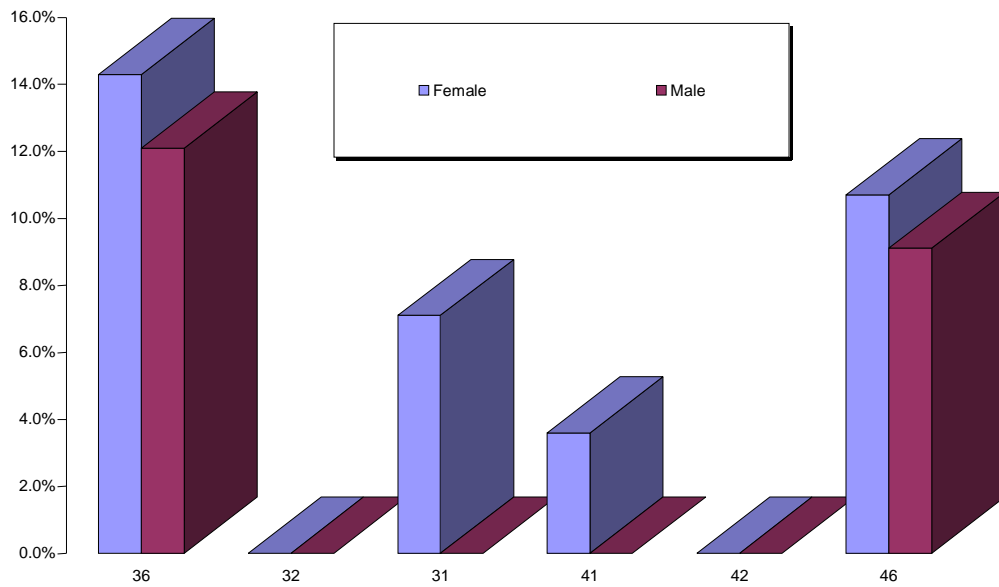


Table 1: Frequency (%) of crowding and spacing in all segments of the maxillary and mandible of male and female children (n= 61)

	Crowding			Spacing		
	Females N(%)	Males N(%)	Total N(%)	Females N(%)	Males N(%)	Total N(%)
Ant max (≥ 2 mm)	2(7.1)	2(6.1)	4(6.6)	4(14.3)	4(12.1)	8(13.1)
Ant max(≥ 4 mm)	12(42.9)	13(39.4)	25(41)	1(3.6)	1(3)	2(3.3)
Right l max (≥ 2 mm)	9(32.1)	12(36.4)	21(34.4)		1(3)	1(1.6)
Left l maxi (≥ 2 mm)	10(35.7)	11(33.3)	21(34.4)		1(3)	1(1.6)
Ant mand (≥ 2 mm)	8(28.6)	4(12.1)	12(19.7)	5(17.9)	3(9.1)	8(13.1)
Ant mand(≥ 4 mm)	9(32.1)	16(48.5)	25(41)	1(3.6)	1(3)	2(3.3)
Right l mand (≥ 2 mm)	6(21.4)	9(27.3)	15(24.6)	1(3.6)	1(3)	2(3.3)
Left l mand (≥ 2 mm)	4(14.3)	10(30.3)	14(23)	1(3.6)	1(3)	2(3.3)

Ant =anterior

Max = maxillary

Mand = mandibular

L=lateral

Table 2: Frequency (%) of occlusal traits in incisal segments of all children (n= 61)

Occlusal traits	Category	Female N(%)	Male N(%)	Total N(%)
Maxillary overjet	≥ 6 mm	1(3.6)	2(6.1)	3(4.9)
	≥ 9 mm	1(3.6)		1(1.6)
Mandibular overjet			1(3)	1(1.6)
Anterior crossbite	1 tooth	4(14.3)	2(6.1)	6(9.8)
	≥ 2 teeth	1(3.6)	1(3)	2(3.3)
	≥ 3 teeth		1(3)	1(1.6)
Overbite	2/3	7(25)	6(18.2)	13(21.3)
	3/3	2(7.1)	1(3)	3(4.9)
Anterior openbite		5(17.9)	5(15.2)	10(16.4)
Midline shift		21(75)	22(66.7)	43(70.5)

Table 3a: Frequency (%) of children with distal or mesial molar relationship

	Class II				Class III			
	Bilateral		Unilateral		Bilateral		Unilateral	
	H unit	F unit	H unit	F unit	H unit	F unit	H unit	F unit
Female	10.7%	0%	14.3%	0%	17.9%	0%	0%	0%
Male	9.1%	0%	15.2%	3%	3%	0%	9%	0%

H =Half

F = Full

Table 3b: Frequency (%) of occlusal traits in lateral segments of female and male children (n=61)

	Crossbite				Openbite	
	Lingual		Buccal		Bilateral	Unilateral
	Bilateral	Unilateral	Bilateral	Unilateral	Bilateral	Unilateral
Female	0%	14.3%	3.6%	7.1%	21.4%	10.7%
Male	3%	6.1%	3%	6.1%	21.2%	18.2%

Table 4: The frequency of treatment need in all children (n = 61), by gender

	Female		Male	
	N	%	N	%
Not necessary	12	42.9	8	24.2
Doubtful	1	3	6	18.2
Necessary	14	50	13	39.4
Urgent	1	3	6	18.2

agreement on each variable were all above 0.8. Inter-examiner calibration was also successfully completed. The kappa values for inter-examiner indicated disagreement in only one variable (midline shift) (0.4) and some other variables were valued less than complete intra-examiner agreement, but still moderate (0.6). The issues which were encountered during the calibration process were raised and solved by group discussion.

Statistical analysis:

SPSS 16 (Statistical package for the Social Sciences; SPSS, Chicago, IL USA) software was used for analysis of raw data and chi-square tests were performed to assess statistical significance between groups. Because of low numbers in some sub-groups, statistical significance testing was not always possible.

Results:

Data on all of the participants were adequately recorded in the study. Those with a history of multiple extractions or previous orthodontic treatment were excluded from this study.

Missing and supernumerary teeth: The frequency of missing first molars (upper and lower) was higher compared to other teeth (Figure 1a and b). Upper right lateral incisors were missing only in 3% of boys, but upper left lateral incisors were all present. Upper right first molars were missing in 6.1% of males and 3.6% of females, whereas left upper first molars were missing in 3% of males only (Figure 1a). Lower right central incisors were missing only in 3.6% of females and lower left central incisors were missing only in 7.1% of females. Right lower first molars were missing in 10.7% of girls and 9.1% of boys, whereas left first molars were missing in 14.3% of males and 6.1% of boys (Figure 1b). In summary first molars were most commonly missing, males tended to have more missing maxillary teeth than females, and females tended to have more missing mandibular teeth than males.

Supernumerary teeth were present in 3.6% of females and 3.0% of males. There was no malformation of any incisors. Ectopic eruption due to abnormal position of a tooth originating in a displacement of the germ itself was present in 3.6% of females only.

Crowding in the maxilla: It was noted that the frequency of maxillary anterior segment crowding was much higher than crowding in the maxillary lateral segments (Table 1). Crowding of 2mm or more in the maxillary anterior segments was recorded in 7.1% of girls and 6.1% of boys and crowding of 4mm or more was recorded in 42.9% of females and 39.4% of males. Crowding of 2mm or more in the right lateral maxillary segments was only recorded in 32.1% of females and 36.4% of males, and in the left lateral maxillary segments was recorded in 35.7% of females and 33.3% of males (Table 1).

Crowding in the mandible:

The frequency of crowding in the mandibular anterior segments were also much higher compared to crowding in the mandibular left and right lateral segments (Table 1). Crowding of 2mm or more in the mandibular anterior segments were recorded in 28.6% of girls and 12.1% of boys. However, crowding of 4mm or more in the mandibular anterior segments was higher, in 32.1% of females and 48.5% of males. Crowding of 2mm or more in the right lateral mandibular segments was recorded in 21.4% of females and 27.3% of males. Crowding of 2mm or more in the left lateral mandibular segments were recorded in 14.3% of females and 30.3% of males (Table 1).

Spacing: Spacing of 2mm or more in the maxillary anterior segment was present in 14.3% of females and 12.1% of males, while spacing of 4mm or more in this segment was recorded in 3.6% of girls and 3.0% of boys (Table 1). Overall, the frequency of spacing in the mandibular anterior segments was greater compared to spacing in the mandibular left and right lateral segments. Spacing of 2mm or more in the mandibular anterior segments were recorded in 17.9% of girls and 9.1% of boys and, spacing of 4mm or more in the mandible anterior segment was lower, present in 3.6% of females and 3% of males. Spacing of 2mm or more in the right lateral mandibular segments was recorded in 3.6% of females and 3% of males. Spacing of 2mm or more in the left lateral mandibular segments was recorded in 3.6% of females and 3% of males (Table 1).

Occlusal traits in the incisal segment: A maxillary overjet of 6mm or more was present in 3.6% of females and 6.1% of males (Table 2), while a maxillary overjet of 9mm or more was recorded in 3.6% of girls. A mandibular overjet was recorded in 3.0% of boys. One incisor in anterior crossbite was recorded in 14.3% of girls and 6.1% of boys, two incisors in anterior crossbite were recorded in 3.6% of females and 3% of males, and three incisors in anterior crossbite were recorded in 3% of boys. An overbite of 2/3 or more was recorded in 25% of

females and 18.2% of males, while an overbite of 3/3 or more was recorded in 7.1% of girls and 3% of boys. Anterior open bite was recorded in 17.9% of girls and 15.2% of boys. A midline shift of 2mm or more was recorded in 75% of females and 66.7% of males (Table 2).

Distal and mesial molar relationships in the lateral segment: Bilateral class II molar occlusion of a half unit was recorded in 10.7% of females and 9.1% of males (Table 3a). Unilateral class II molar occlusion (right or left) of a half unit was recorded in 14.3% of girls and 15.2% of boys. However, unilateral class II molar occlusion (right or left) of a full unit was less, present only in 3% of boys (Table 3a). Bilateral class III molar occlusion of a half unit was recorded in 17.9% of girls and 3.0% of boys. However, unilateral class III molar occlusion (right or left) of a half unit was recorded only 9.1% of males (Table 3a). Bilateral posterior openbite was recorded in 21.4% of females and 21.2% of males, while unilateral posterior openbite (right or left) was recorded in 10.7% of girls and 18.2% of boys (Table 3b). Bilateral lingual posterior crossbite was recorded in 3% of males, while unilateral lingual posterior crossbite (right or left) was recorded in 14.3% of girls and 6.1% of boys (Table 3). Bilateral buccal posterior crossbite was recorded in 3.6% of females and 3% of males, while unilateral buccal posterior crossbite (right or left) was recorded in 7.1% of girls and 6.1% of boys (Table 3b).

Indications for orthodontic treatment: No need for orthodontic treatment was indicated in 42.9% of females and 24.2% of males (Table 4). However, need for orthodontic treatment was recorded in 50% of females and 39.4% of males. The need for urgent orthodontic treatment was indicated in 3.6% of girls and 18.2% of boys.

Discussion:

This study appears to be the first baseline analysis of dental malocclusion in Cambodia. The sample was a small but representative sample of the Cambodian 13-15 year old population in Teuk Klaing, and

provides a unique insight into the orthodontic treatment issues facing this country.

The frequency of missing teeth was high among first molars compared to other teeth. The frequency of high first molar loss has also been previously reported in other studies, ranging from 6% to 43%.⁸⁻¹¹

The frequency of missing incisors in this study ranged from 3% to 7.1%. This is in accordance with other international studies, where frequencies ranged from 1.1% to 12%.^{3,6,7} The results from these studies for lateral missing teeth (1.1% to 12.2%) were higher than our results (0% -3%).^{9,12,13}

The frequency of supernumerary teeth which recorded in this study was slightly less compared to Davis's study¹⁴ (which reported 4.6% of males and 0.8% of females), but higher than 2 other studies.^{15,16}

The frequencies of crowded teeth in maxillary and mandibular incisor segments were higher in this survey compared to other studies.^{10,16-18} Remarkably, the percentage of 4mm or more crowded teeth in maxillary and mandibular incisor segments was higher compared to 2mm or more crowded teeth in this segment. Precaution should be taken when comparing the results for crowding or spacing, as the different studies used different criteria to measure occlusal traits.

In this study, the point of demarcation between the segments was the mesial surface of the canine, not the distal surface of the lateral incisors. Some other studies^{10, 16-18} used the distal surface of the lateral incisors as the point of demarcation between the segments. Consequently, this study reported the frequency of crowding or spacing in both maxillary and mandibular incisal segments higher than other studies. However, the result from this study was similar to some other epidemiological and clinical studies. For instance, Makoni¹⁹ found 67.5% of crowded teeth in maxillary and 60.5% of crowded teeth in mandible in 14-year olds. McGann²⁰ also suggested that Asians persons are more likely to have crowded teeth in anterior

segments compared to European and Caucasians persons. Some also indicated that the anterior irregularities were the most common space condition recorded.^{18,21}

The frequencies of crowded teeth in the lateral maxilla and mandibular segments were more or less similar but decreased when compared to the frequencies of crowded teeth in the maxillary and mandibular incisor segments. Previous work reported similar results.¹⁰⁻¹⁶

The frequency of spacing in the maxillary and mandibular incisor segments in this study was not different from previous findings.^{10,17,22}

In this study, the frequency of overbite of 2/3 or more was high. Care should be taken however when comparing to other studies as different studies used different criteria to record overbite cases. Some others considered the overbite measurements to the nearest whole millimetre.^{17,18-23} In this study, overbite cases were considered 2/3 or more and 3/3 or more of the lower incisors. However, the frequency of overbite was comparable to the results of Haynes, Muniz and Lund.^{8,16,24}

The frequency of anterior openbite was recorded in 17.9% of girls and 15.2% of boys in this study. It was slightly higher than previously measured.^{6,10,11,16} The frequency of bilateral class II molar occlusion of a half unit was similar to the findings of others^{11,23}. Cons et al. indicated a higher frequency of bilateral class II molar relationship of a half unit or more.¹⁷ However, Lund's study reported the frequency of this trait less than the present study.¹⁶ The frequency of unilateral (right or left) class II molar occlusion of half unit was reported more or less similar to others^{16,25} Some however, reported triple frequency of this occlusal trait.^{10,11,23} The frequency of bilateral class III molar occlusion of a half unit was high for girls compared to others.^{11,16,17,23} However, it was comparable to these same study results for boys. Remarkably, unilateral class III molar occlusion (right or left) of a half unit was not noted in any girls in this study but accounted for 9.1% in

boys. This frequency of occlusal traits was also comparable to others.^{11,16,17,23}

This study recorded the need for necessary orthodontic treatment at 50% for females and 39.4% for males. This frequency was slightly higher than for other study populations.^{8,16,25} However, the need for treatment categories "treatment not necessary", "treatment doubtful" and "treatment urgent" were recorded much similar to the above studies.

Conclusion:

These outcomes indicate a high prevalence of certain occlusal traits, and also a high need for orthodontic treatment among adolescents in the Teuk Klaing commune. This data will be useful for public oral health service and policy planning, and emphasize the need for orthodontic treatment among Cambodian adolescents.

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