

OCCLUSAL FEATURES OF CHINESE ADULTS IN HONG KONG

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The molar relations, overjet and overbite of 201 Hong Kong Chinese adults of mean age 20 years were studied. It was found that 63.7 per cent had Angle Class I, 16.4 per cent had Class II and 19.9 per cent had Class III molar relations. Of the sample studied, 69.7 per cent had normal overjets of two to four mm, 14.9 per cent had increased overjets and 15.4 per cent had reduced or reversed overjets. The most prevalent overbite was zero to one-third of the mandibular central incisor crown length (63.2 per cent of the sample); 31.3 per cent had overbites of one to two thirds of mandibular central incisor crown length; four per cent had overbites of more than two thirds of mandibular incisor crown length; and 1.5 per cent only had open bites.

Key Words:

Molar relations, overjet, overbite, Chinese.

Introduction

The occlusal features of whites and blacks have been studied extensively, but similar studies of Chinese populations are few. The objective of the present study was to accumulate more epidemiological data on the prevalence of the various occlusal features among Chinese adults. The features studied include: molar relations defined according to Angle's Classification,¹ incisor overjet and overbite. Results of the present study were compared to the data obtained in the previous studies.

Literature Review

Epidemiological data concerning the occlusal features of whites and blacks have been done mostly on American whites and blacks and are plentiful. Data concerning the occlusal features of Chinese are scanty.⁷ Results of some of these studies are reviewed.

Molar Relations

One of the first recorded studies of the frequency distribution of molar relations was that of Angle.¹ He examined several thousand cases of malocclusion and found that 69.2 per cent had Class I, 26.6 per cent had Class II, and 4.2 per cent had Class III molar relations. However, the sample in Angle's study was not random but instead restricted to individuals presenting with a malocclusion; therefore these percentages of frequency distribution do not represent the true prevalence of Class I, II and III molar relations in a normal population.

Altemus² studied approximately 3,500 American Negro children between twelve and sixteen years of age who were in the permanent dentition stage and had received no orthodontic

treatment. He found that 82.88 per cent had Class I, 12.13 per cent had Class II, and 4.99 per cent had Class III molar relations.

Emrich, Brodie and Blayney³ studied the molar relations of 13,475 white and 1,476 American black children who were twelve to fourteen years old. Amongst the white subjects, he found 84 per cent had Class I, 15 per cent had Class II and only one per cent had Class III molar relations. Of the black children, 89 per cent had Class I, seven per cent had Class II and three per cent had Class III relations. He also found no difference between the sexes in the two groups.

During 1966-70, the Division of Health Examination Statistics of the United States conducted a survey of the health of the United States population aged between twelve and seventeen years.⁴ The target population totalled approximately 22.7 million and were all non-institutionalised civilian youths living in the United States (including Alaska and Hawaii); those on lands reserved for the use of American Indians were not included. A probability sample of about 7,500 was selected by a complex scientific procedure so that statistically valid estimates about the health of the nation's youth could be made. It was found that 52.2 per cent of the whites had Class I, 33.6 per cent had Class II, 13 per cent had Class III, and 1.2 per cent had mixed molar relations. Of the blacks, 62.4 per cent had Class I, 18 per cent had Class II, 18.6 per cent had Class III and one per cent had mixed molar relations.

Horowitz and Doyle⁵ studied 321 white and 397 black school children aged between two and twelve years. They found that 53.6 per cent of the

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white children had Class I, 33.6 per cent had Class II and 4.7 per cent had Class III molar relations; and 8.1 per cent had missing first molars or bilaterally mixed mesio- and distocclusions. Of the black children, 76.8 per cent had Class I, 11.4 per cent had Class II and 6.3 per cent had Class III molar relations; 5.5 per cent had missing first molars or bilaterally mixed mesio- and distocclusion.

In 1985, Garner and Butt⁶ published data from their study of 445 American blacks. They found that 71 per cent had Class I, 16 per cent had Class II, 8.7 per cent had Class III and 4.3 per cent had asymmetrical molar relations.

In 1989, Woon, Thong and Kadir⁷ studied 154 Chinese school children in Malaysia who were in their permanent dentition stage. They found that 47.06 per cent had Class I molar relations; 6.72 per cent had unilateral Class I and Class III relations; 6.72 per cent had bilateral Class II relations; 15.97 per cent unilateral Class I and Class III relations; 18.49 per cent had bilateral Class III relations; and 5.04 per cent had asymmetrical Class II and III molar relations.

Overjet

The United States National Health Survey of twelve- to seventeen-year-old children conducted in 1966-70 revealed that, of the white subjects, 2.1 per cent had negative overjets, 3.7 per cent had over jets of zero to one mm, 66.4 per cent had overjets of two to four mm, 19.4 per cent had overjets of five to six mm and 8.4 per cent had overjets of seven mm or above. Of the black subjects, 4.8 per cent had negative overjets, 6.2 per cent had overjets of zero to one mm, 65.3 per cent had overjets of two to four mm, 18.2 per cent had overjets of five to six mm, and 5.5 per cent had overjets of 7 mm or more.

Horowitz and Doyle⁸ also studied the overjet and overbite of the 321 white and 397 black school children previously mentioned. They found that black children tended to have lower overjet scores than did white. Of the black children, 19.6 per cent had an overjet less than or equal to 2 mm while only 10.2 per cent of the white children had a similar overjet. In the upper range of overjet measurements, 13 per cent of the white subjects had an overjet of

7 mm or more, whereas only 8 per cent of the black subjects had a similar overjet.

Woon *et al*⁷, when they studied the 154 Chinese school children in Malaysia, defined an overjet of two to four mm as "ideal" and found that 28.19 per cent of the subjects fell into this group. They also found that 4.7 per cent had negative or reversed overjets while 54.36 per cent had edge-to-edge overjets of zero to one mm; and 12.75 per cent had an increased overjet of more than four mm.

Overbite

Data from the United States Health Survey conducted in 1966-70⁴ revealed that open bite relation was more common in black individuals (16.3 per cent) than in white (3.5 per cent). Of the whites, 0.2 per cent, and of the blacks, 0.5 per cent had zero mm overbite. Of the whites, 22.9 per cent had overbites of one to two mm; 43.1 per cent had overbites of three to four mm; and 30.3 per cent had overbites of five mm or more. Of the blacks, 40.1 per cent had overbites of one to two mm; 35.5 per cent had overbites of three to four mm; and only 9.4 per cent had overbites of five mm or more. Deep overbites was therefore more common in whites than in blacks.

Horowitz and Doyle⁸ also found that there was a pronounced tendency for the white children to have greater overbites than the black children. They found that 48.6 per cent of the whites had an overbite of 5 mm or more, while only 15.9 per cent of the blacks had similar overbites. They also found open bite to be more common among the blacks (4.8 per cent) than the whites (1.2 per cent). Of the whites, 0.3 per cent had an edge-to-edge bite, 12.1 per cent had overbites of one to two mm, and 37.7 per cent had overbites of three to four mm. Of the blacks, 4.8 per cent had edge-to-edge bites, 29.2 per cent had overbites of one to two mm and 45.3 per cent had overbites of three to four mm.

Woon *et al*⁷ also studied the Malaysian Chinese school children's overbites. It was recorded as that portion of the lower incisors (in crown thirds) overlapped by the upper incisors. Of this group, 6.04 per cent were found to have open bites; of the remaining 93.96 per cent, 59.06 per cent (55.49 per cent of the whole sample) had

overbites of zero to one third overlap of the lower incisors by the upper incisors; 29.53 per cent (27.75 per cent of the whole sample) fell into the one to two thirds group; 8.05 per cent (7.56 per cent of the whole sample) into the two to three thirds group; while 3.36 per cent (3.16 per cent of the whole sample) were in the greater than three-thirds group.

Materials and Methods

Between the years 1981 and 1990, dental impressions for study cast records were taken for eight batches of first year dental students of the University of Hong Kong. Approximately 440 records were obtained, 5.4 per cent of which had had orthodontic treatment before. The sample of the present study included: 108 males from two randomly selected batches of first year dental students; all the female students (61) and 32 female trainee dental surgery assistants in the Prince Philip Dental Hospital in Hong Kong. All the students or trainees who had received orthodontic treatment were excluded. The criteria for admission to the Faculty of Dentistry in the University of Hong Kong is based on academic achievement and the student's performance in an "aptitude test" which tested finger and hand control. The trainee dental surgery assistants were recruited on the basis of their achievement in public examinations. Therefore, there is no obvious bias regarding occlusal features in the sample selected when compared to the general population in Hong Kong. The study casts of the 201 subjects (108 male and 93 female) were studied and their occlusal features were measured as follows:

Molar Relations (Angle's Classification)¹

1. Class I - bilateral
2. Class II - unilateral
 - (i) Half-unit Class II
 - (ii) More than half-unit Class II
3. Class II - bilateral
 - (i) Half-unit Class II on both sides
 - (ii) One side half-unit, one side more than half-unit Class II
 - (iii) More than half-unit Class II on both sides
4. Class III - unilateral
 - (i) Half-unit Class III
 - (ii) More than half-unit Class III
5. Class III - bilateral
 - (i) Half-unit Class III on both sides

- (ii) One side half-unit, one side more than half-unit Class III
(iii) More than half-unit Class III on both sides.

Overjet

Overjet was measured in millimetres. It was measured as the distance from the labial surface of the maxillary central incisor to the labial surface of the mandibular central incisor. The distance was measured horizontally, parallel to the occlusal plane. The overjet measurements were grouped into the following ranges:

1. Less than zero mm (reversed overjet)
2. zero to one mm (reduced overjet)
3. two to four mm (normal overjet)
4. five to six mm (increased overjet)
5. seven mm or more (markedly increased overjet).

Overbite

Overbite was measured as the portion of mandibular central incisor overlapped by the maxillary central incisor when the jaws are in the centric occlusion. The overlapping distance was scored in "thirds" of the length of the clinical crown of the mandibular central incisor, as follows:

1. Open bite
2. zero to one third of mandibular central incisor crown length
3. one to two thirds of mandibular central incisor crown length
4. two to three thirds of mandibular central incisor crown length
5. More than three thirds of mandibular central incisor crown length.

Results

The mean age of the 108 male subject was 20.2 years (standard deviation = 0.98 year) and that of the 93 female subjects 19.8 years (standard deviation = 1.2 years). The mean age of the whole sample was 20.0 years. The frequency distribution of the molar relations of the sample is presented in Table 1. The prevalence of the various ranges of overjet is presented in Table 2, and that of the overbite, in Table 3. No statistically significant difference was found between the female and male subjects in any of the features studied.

Discussion

It was obvious that data from different studies regarding the distribution of molar relations even for

Table 1: Frequency Distribution of Molar Relations

Molar Relations		Female N (%)	Male N (%)	Whole Sample N (%)
Class I		58 (62.4)	70 (64.8)	128 (63.7)
Class II	1/2 unit unilateral	7 (7.75)	7 (6.5)	14 (7.0)
	> 1/2 unit unilateral	5 (5.4)	4 (3.7)	9 (4.5)
	1/2 unit bilateral	0 (0.0)	1 (0.9)	1 (0.5)
	1 side 1/2 unit			
	1 side > 1/2 unit	1 (1.1)	1 (0.9)	2 (1.0)
	> 1/2 unit bilateral	3 (3.2)	4 (3.7)	7 (3.5)
	TOTAL	16 (17.2)	17 (15.7)	33 (16.4)
Class III	1/2 unit unilateral	9 (9.7)	13 (12.0)	22 (10.9)
	< 1/2 unit unilateral	2 (2.2)	0 (0.0)	2 (1.0)
	1/2 unit bilateral	3 (3.2)	4 (3.7)	7 (3.5)
	1 side 1/2 unit			
	1 side > 1/2 unit	4 (4.3)	4 (3.7)	8 (4.0)
	> 1/2 unit bilateral	1 (1.1)	0 (0.0)	1 (0.5)
	TOTAL	19 (20.4)	21 (19.4)	40 (19.9)

Table 2: Frequency Distribution of Overjets

Overjet (mm)	Female N (%)	Male N (%)	Whole Sample N (%)
< 0	2 (2.2)	2 (1.9)	4 (2.0)
0 - 1	12 (12.9)	15 (13.9)	27 (13.4)
2 - 4	63 (67.7)	77 (71.3)	140 (69.7)
5 - 6	12 (12.9)	11 (10.2)	23 (11.4)
> 7	4 (4.3)	3 (2.8)	7 (3.5)
TOTAL	93 (100)	108 (100)	201 (100)

Table 3: Frequency Distribution of Overbites

Overlapped Portion of Mandibular Central Incisor	Female N (%)	Male N (%)	Whole Sample N (%)
Openbite	2 (2.2)	1 (0.9)	3 (1.5)
0 - 1/3	60 (64.5)	67 (62.0)	127 (63.2)
1/3 - 2/3	30 (32.3)	33 (30.6)	63 (31.3)
2/3 - 3/3	0 (0.0)	7 (6.5)	7 (3.5)
> 3/3	1 (1.1)	0 (0.0)	1 (0.5)
TOTAL	93 (100)	108 (100)	201 (100)

the same race (American blacks or American whites) could vary dramatically. The criteria for classifying a molar relation as Class I, II, or III were not clearly described in most of the studies except the United States National Health Survey.⁴ In this large survey, as little as a cusp-to-cusp deviation in the relation of the 6-year molars was classified as either "mesiocclusion" or "distocclusion", even if the deviation occurred on one side only. This may be the reason why the percentages of Class

II and Class III molar relations found in both the whites and blacks were the highest of the various studies, and the percentage of Class I molar relations the lowest. However, the criteria for studying the molar relations in the present study were exactly the same as the above survey done by the United States National Health Service. The author considers the results of this last mentioned survey more representative than the others because of the large number of subjects studied and because

Table 4: Percentage Distribution of Molar Relations Among American Whites, American Blacks⁴, Malaysian Chinese⁷ and Hong Kong Chinese (Present Study)

Molar Relations	American White ⁴	American Black ⁴	Malaysian Chinese ⁷	Hong Kong Chinese (Present Study)
Class I	52.5	62.4	47.06	63.7
Class II	33.6	18.0	13.44	16.4
Class III	13.0	18.6	34.46	19.9
Asymmetrical/ Others	1.2	1.0	5.04	0.0

Table 5: Percentage Distribution of Overjet Among American Whites, American Blacks⁴, Malaysian Chinese⁷ and Hong Kong Chinese (Present Study)

Overjet (mm)	American White ⁴	American Black ⁴	Malaysian Chinese ⁷	Hong Kong Chinese (Present Study)
< 0	2.1	4.8	4.7	4.0
0 - 1	3.7	6.2	54.36	13.4
2 - 4	66.4	65.3	28.19	69.7
5 - 6	19.4	18.2	-	11.4
> 7	8.4	5.5	-	3.5

Table 6: Percentage Distribution of Overbites in the Two Chinese Studies

Overbite (overlapped portion of mandibular incisor)	Malaysian Chinese ⁴	Hong Kong Chinese (Present Study)
Overbite	6.04	1.5
0 - 1/3	55.49	63.2
1/3 - 2/3	27.75	31.3
2/3 - 3/3	7.56	3.5
> 3/3	3.16	0.5

the sampling method was designed in such a way that statistically valid estimates of the health of the Nation's youth could be made. Results of the present study will be compared to data obtained from that particular study.

Table 4 shows the percentage distribution of the molar relations found in the United States National Health Survey⁴, the Malaysian Chinese study⁷ and the present Hong Kong Chinese study. When the American whites and blacks⁴ were compared, there were fewer whites with Class I or Class III molar relations than blacks; but Class II molar relations were much more prevalent in the whites than in the blacks.

The percentage distribution of molar relations found among the Malaysian Chinese⁷ and that of the Hong Kong Chinese in the present study differs significantly, especially in the prevalence of Class I and Class III relations. This may be due to a number of factors. The majority of the Hong Kong population (98.3 per cent) is Chinese⁸ who, until 20 to 30 years ago rarely intermarried with other races. Therefore, the author expects that the sample assessed in the present study was mostly pure Chinese. However, Malaysia is a multi-racial country; 59 per cent of the population are Malays and other Bumiputera, 32.1 per cent Chinese, 8.2 per cent Indians and 0.7 per cent other races.⁹ Whether or not the sample studied by Woon, Thong and Kadir was made up of pure Chinese was not clearly stated in their report. One may assume that inter-racial marriage is much more common in this country and so there may be some genetic influence from other races in the Malaysian Chinese surveyed.

On the other hand, if the percentage distribution of molar relations of the Hong Kong Chinese in the present study and that of the American whites and blacks⁴ (Table 4) are compared, it will be found to be very similar to that of the

American blacks. The percentage distribution of Class I, II and III molar relations of the Hong Kong Chinese and American blacks are similar, differing by less than two per cent. Hong Kong Chinese in the study, like the American blacks, have more Class I and Class III, and fewer Class II molar relations than the American whites.

The most prevalent overjet among the subjects assessed in the present study was two to four mm; 69.7 per cent of the subjects had overjets falling within this range (see Table 2). This was considered by some researchers as the "ideal" or "normal" overjet.^{7,10} An increased overjet of five to six mm was present in 11.4 per cent of the sample, and 3.5 per cent had a markedly increased overjet of seven or more millimetres. Therefore, a total of 14.9 per cent had an increased overjet; this correlates well with the figure for Class II molar relation which was 16.4 per cent. On the other hand, 13.4 per cent of the sample had reduced overjet of zero to one millimetre and two per cent had a reversed overjet; which made up a total of 15.4 per cent having reduced or reversed overjet. Of the present sample, 19.9 per cent were found to have Class III molar relations. Some cases had Class II or Class III molar relations but no increased or reduced overjets respectively. This may be explained by the fact that even though unilateral half-unit Class II or Class III molar relations were counted in this study, these mild cases might not show increased or reduced overjets of the central incisors.

The percentage distribution of overjets in American whites and blacks,⁴ Malaysian Chinese and Hong Kong Chinese in the present study are shown in Table 5. The percentage of negative overjets in American blacks, Malaysian Chinese and Hong Kong Chinese are very similar (varying from 4 to 4.8 per cent), but considerably fewer American whites (only 2.1 per cent) had negative overjets. A total of 27.8 per cent of American whites had increased overjets of 5 mm or more, and 23.2 per cent of the American blacks had similar overjets. Considerably fewer Chinese were found to have increased overjets of 5 mm or more; 12.75 per cent among the Malaysian Chinese and 14.9 per cent among the Hong Kong Chinese.

The percentages of American whites, blacks and Hong Kong Chinese having

the "ideal" overjet of two to four mm were very similar (66.4 per cent, 65.3 per cent and 69.7 per cent respectively), and these percentages comprised the majority of the studied populations. The most prevalent (54.36 per cent) overjet among the Malaysian Chinese was zero to one millimetre. However, in all the groups the percentage of the population having reduced (0-1 mm) and ideal (2-4 mm) overjets were: 70.1 per cent of whites, 71.5 per cent of blacks, 82.55 per cent Malaysian Chinese and 83.1 per cent Hong Kong Chinese.

The majority (63.2 per cent) of the subjects assessed had a normal overbite of zero to one third crown length of the mandibular central incisors (refer to Table 3). Less than one third of the sample (31.3 per cent) had a slightly increased overbite of one to two thirds of mandibular central incisor crown length. Only four per cent had any increased overbite of more than two thirds mandibular central incisor crown length, and 1.5 per cent were found to have an anterior open bite.

The over bites of the Hong Kong Chinese population in the present study were compared to the data found among the Malaysian Chinese (Table 6). These data cannot be compared to those found among the American whites or blacks in the United States National Health Survey because of differences in the method of scoring. More Malaysian Chinese (6.04 per cent) had an open bite than the Hong Kong Chinese (1.5 per cent). The most prevalent overbites in both populations were zero to one-third overlap of mandibular incisors - considered the "normal" overbite. The incidence of deep overbites of greater than two-thirds of lower incisor crown length was also more prevalent among the Malaysian Chinese (10.72 per cent) than the Hong Kong Chinese (only four per cent).

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