# **Original Article**

# **Dental Arch Widths of Southern Chinese**

## John Y.K. Ling<sup>a</sup>; Ricky W.K. Wong<sup>b</sup>

#### ABSTRACT

**Objective:** To investigate the dental arch width of the Southern Chinese across buccal cusps, central fossae, or lingual cusps and compare these values with study findings in different populations and using different definitions.

**Materials and Methods:** The dental arch dimensions of study casts of an unselected sample from a 12-year-old Hong Kong Oral Health Survey of 12-year-old children (n = 358; 210 boys and 148 girls) were measured.

**Results:** When compared with Caucasians, the Southern Chinese were characterized by a wider dental arch width. However, variations were great. All maxillary and mandibular male arch widths were significantly larger than female arch widths, except at the incisor regions.

**Conclusion:** This study yielded a database about dental arch widths by which different studies on these widths can be compared. (*Angle Orthod.* 2009;79:54–63.)

KEY WORDS: Dental arch width; Southern Chinese

#### INTRODUCTION

In the clinical dental field, arch size and shape are of particular interest to orthodontists and prosthodontists. In the anthropologic field, studies on dental arches have been conducted directly or indirectly. Direct methods involved measurements.<sup>1</sup>

Various landmarks have been described and discussed by different investigators, but universal agreement on how dental arch width should be determined has not been reached. Most studies used the dimension of the arch across the permanent canines, premolars, and first molars, at the cusp tips, central fossae, or contact points, or the greatest distance between buccal surfaces.<sup>1–11</sup>

Dental arch widths between contralateral teeth have been measured in many ways: between the most labial points<sup>1</sup> or the most palatal or lingual points,<sup>11–20</sup> or as a calculated mean between the most labial and palatal measurements.<sup>21</sup> Thus, the different landmarks

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Accepted: December 2007. Submitted: September 2007. © 2009 by The EH Angle Education and Research Foundation, Inc. used in these studies have made comparisons between various studies difficult, let alone comparisons between populations. In view of this, it is necessary to investigate the dental arch width while establishing definitions that can become a standard for comparisons among different studies.

The aim of the present study was to investigate the dental arch width of the Southern Chinese across the buccal cusps, central fossae, or lingual cusps, and to compare these values with those attained in various studies from different populations.

"Southern Chinese" are defined as those Chinese whose ancestors originated from provinces south of the Yangtze River, and who speak dialects different from those of Northerners. The hypothesis was that no differences are present in dental arch widths between males and female members of a Southern Chinese population.

#### MATERIALS AND METHODS

Dental study casts (n = 358; 210 boys and 148 girls) were obtained as part of a multidisciplinary survey in a cross-sectional, randomly selected sample of 1247 12-year-old Chinese children from the Oral Health Project in Hong Kong.<sup>22,23</sup> Teeth found to be carious, missing, restored at the measurement landmark, hypoplastic, worn or malformed, or orthodontically moved were excluded from the present investigation. Damaged casts, which made measurement **DOI:** 10.2319/092007-452.1

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Table 1. Landmarks and Reference Points for Measurements of Dental Arch Dimension: Maxillary Arch

Reference <sup>a</sup>	Location of Landmarks
U7CC	Central fossa of tooth 17 and tooth 27
U7ML	Mesial palatal cusp of tooth 17 and tooth 27
U7MG	Most prominent palatal point at the gingival margin opposite the mesial palatal cusp of tooth 17 and tooth 27
U7DL	Distal palatal cusp of tooth 17 and tooth 27
U7DC	Estimated distal contact point between tooth 17 and tooth 18 and tooth 27 and tooth 28
U7DB	Distal buccal cusp of tooth 17 and tooth 27
U7CB	Buccal groove at the buccal and occlusal surface interface of tooth 17 and tooth 27
U7MB	Mesial buccal cusp of tooth 17 and tooth 27
U7MC	Contact points between tooth 16 and tooth 17 and tooth 26 and tooth 27
U6CC	Mesial fossa of tooth 16 and tooth 26
U6ML	Mesial palatal cusp of tooth 16 and tooth 26
U6MG	Most prominent palatal point at the gingival margin opposite the mesial palatal cusp of tooth 16 and tooth 26
U6DL	Distal palatal cusp of tooth 16 and tooth 26
U6DB	Distal buccal cusp of tooth 16 and tooth 26
U6CB	Buccal groove at the buccal and occlusal surface interface of tooth 16 and tooth 26
U6MB	Mesial buccal cusp of tooth 16 and tooth 26
U6MC	Contact points between tooth 15 and tooth 16 and tooth 25 and tooth 26
U5CC	Central fossa of tooth 15 and tooth 25
U5CL	Palatal cusp of tooth 15 and tooth 25
U5CG	Most prominent palatal point at the gingival margin opposite the palatal cusp of tooth 15 and tooth 25
U5CB	Buccal cusp of tooth 15 and tooth 25
U5MC	Contact points between tooth 14 and tooth 15 and tooth 24 and tooth 25
U4MC	Central fossa of tooth 14 and tooth 24
U4CL	Palatal cusp of tooth 14 and tooth 24
U4CG	Most prominent palatal point at the gingival margin opposite the palatal cusp of tooth 14 and tooth 24
U4CB	Buccal cusp of tooth 14 and tooth 24
U4MC	Contact points between tooth 13 and tooth 12 and tooth 23 and tooth 22
U3CL	Lingual gingival margin of tooth 13 and tooth 23
U3CB	Cusp tip of tooth 13 and tooth 23
U3MC	Contact points between tooth 12 and tooth 13 and tooth 22 and tooth 23
U2MC	Contact points between tooth 11 and tooth 12 and tooth 21 and tooth 22

<sup>a</sup> U indicates upper; 1, central incisor; 2, lateral incisor; 3, canine; 4, first premolar; 5, second premolar; 6, first molar; 7, second molar; D, distal; C, central; M, mesial; B, buccal; L, lingual; and G, gingival.

data questionable, also were omitted. Only study casts with permanent dentitions were included in the study. The various malocclusions demonstrated in the study casts followed the prevalence of malocclusion of the population, with around one-fifth showing a Class II malocclusion.

Sliding dial calipers (Mitutoyo Manufacturing Co. Ltd, Kawasaki, Japan), accurate to within  $\pm 0.02$  mm, were used to carry out all manual measurements. The beaks of the calipers were machine-sharpened to a fine taper. Dental arch widths were recorded manually to the nearest 0.01 mm, after initial calibration had been provided by another orthodontist. All measurements were made and recorded by the author. The reference points and landmarks are shown in Tables 1 and 2 and Figures 1 to 3.

The method error, which represents the uncertainty of the individual observation of a variable, was determined by means of duplicate measurements of all variables. The study casts of participants from the first school were used in the pilot study. Eighteen randomly selected study casts taken from the study were measured and analyzed on two different occasions at an interval of at least 3 months. The error for the method was calculated for all parameters through the double determination method.<sup>24</sup> The method error for manual measurements of arch dimensions was within 0.1 mm.

The magnitude of this error was similar to those of previous studies.<sup>25,26</sup> Paired *t*-tests were also performed to compare intraobserver measurements. The two-tailed *P* value was greater than .05 and was considered not significant. It was considered unnecessary to take an extra alginate impression for dental study cast to account for the variance due to dimensional changes in the impression material and the dental stone. This variance was considered to be very small compared with that caused by the error of measurement.<sup>25</sup>

## RESULTS

The results of dental arch widths with different definitions are presented in Tables 3 to 7. All male maxillary and mandibular arch widths were significantly larger than female arch widths (*t*-tests; P < .05), except in the incisor regions (Table 3).

### DISCUSSION

This young group of Southern Chinese was chosen for measurement to minimize the alteration of dental arch dimensions because of attrition, restoration, or caries. Efforts were made to ensure randomization and adequate sample size to ensure validity and adequate clinical significance of the prediction equations.

Table 2. Landmarks and Reference Points for Measurements of Dental Arch Dimension: Mandibular Arch

Referenceª	Location of Landmarks
L7CC	Central fossa of tooth 37 and tooth 47
L7DL	Distal palatal cusp of tooth 37 and tooth 47
L7DG	Most prominent point at the gingival margin opposite the distal lingual cusp of tooth 37 and tooth 47
L7ML	Mesial lingual cusp of tooth 37 and tooth 47
L7MG	Most prominent point at the gingival margin opposite the mesial lingual cusp of tooth 37 and tooth 47
L7MC	Contact points between tooth 36 and tooth 37 and tooth 46 and tooth 47
L7MB	Mesial buccal cusp of tooth 37 and tooth 47
L7CB	Buccal groove at the buccal and occlusal surface interface of tooth 37 and tooth 47
L7DB	Distal buccal cusp of tooth 37 and tooth 47
L7DC	Estimated distal contact point between tooth 37 and tooth 38 and tooth 47 and tooth 48
L6CC	Central fossa of tooth 36 and tooth 46
L6DL	Distal lingual cusp of tooth 36 and tooth 46
L6ML	Mesial lingual cusp of tooth 36 and tooth 46
L6MG	Most prominent lingual point at the gingival margin opposite the mesial lingual cusp of tooth 36 and tooth 46
L6MC	Contact points between tooth 35 and tooth 36 and tooth 45 and tooth 46
L6MB	Mesial buccal cusp of tooth 36 and tooth 46
L6CB	Buccal groove at the buccal and occlusal surface interface of tooth 36 and tooth 46
L6DB	Distal buccal cusp of tooth 36 and tooth 46
L5CC	Central fossa of tooth 35 and tooth 45
L5CL	Lingual cusp of tooth 35 and tooth 45
L5CG	Most prominent lingual point at the gingival margin opposite the lingual cusp of tooth 35 and tooth 45
L5MC	Contact points between tooth 34 and tooth 35 and tooth 44 and tooth 45
L5CB	Buccal cusp of tooth 35 and tooth 45
L4CC	Distal fossa of tooth 34 and tooth 44
L4CL	Lingual cusp of tooth 34 and tooth 44
L4CG	Most prominent lingual point at the gingival margin opposite the lingual cusp of tooth 34 and tooth 44
L4CB	Buccal cusp of tooth 34 and tooth 44
L4MC	Contact points between tooth 33 and tooth 34 and tooth 43 and tooth 44
L3CG	Most prominent lingual point at the gingival margin of tooth 33 and tooth 43
L3CB	Cusp tip of tooth 33 and tooth 43
L3MC	Contact point between tooth 33 and tooth 32 and tooth 43 and tooth 44
L2MC	Contact point between tooth 32 and tooth 31 and tooth 42 and tooth 41

<sup>a</sup> L indicates lower; 1, central incisor; 2, lateral incisor; 3, canine; 4, first premolar; 5, second premolar; 6, first molar; 7, second molar; D, distal; C, central; M, mesial; B, buccal; L, lingual; and G, gingival.

Landmarks <sup>a</sup>	Sex	N <sup>a</sup>	Mean $\pm$ SE <sup>a</sup>	SDª	Min-Max <sup>a</sup>	CV <sup>a</sup>	dfª	P Value (M-F) <sup>a</sup>		
Tooth 11-12										
U2MC	М	223	$17.82 \pm 0.267$	3.98	13.60-72.43	0.22				
U2MC	F	134	$17.17\pm0.097$	1.12	13.20-21.06	0.06	276	*		
Tooth 12-22										
U3MC	М	220	29.55 ± 0.184	2.73	14.26-37.07	0.09				
U3MC	F	135	$29.02\pm0.164$	1.90	22.82-33.08	0.06	347	*		
Tooth 13-23										
U4MC	М	205	38.13 ± 0.191	2.73	24.83-52.90	0.07				
U4MC	F	134	$36.94 \pm 0.198$	2.29	30.26-46.52	0.06	337	***		
U3CL	Μ	153	$27.33 \pm 0.146$	1.80	23.00-35.58	0.06				
U3CL	F	121	$26.10 \pm 0.167$	1.84	21.69-31.72	0.07	272	***		
U3CB	Μ	166	$36.92 \pm 0.230$	2.99	16.64-48.98	0.08				
U3CB	F	124	$35.09 \pm 0.316$	3.52	23.64–39.84	0.10	288	***		
Tooth 31–41										
L2MC	Μ	210	$11.21 \pm 0.119$	1.73	6.66-12.56	0.15				
L2MC	F	132	$11.04 \pm 0.101$	1.16	8.17-19.72	0.11	339	NS		
Tooth 32-42										
L3MC	М	206	21.97 ± 0.125	1.80	11.84-24.98	0.08				
L3MC	F	132	$21.90\pm0.139$	1.60	11.30-24.86	0.07	336	NS		
Tooth 33–43										
L3CG	М	177	21.15 ± 0.151	2.01	9.06-28.90	0.10				
L3CG	F	125	$20.18 \pm 0.149$	1.66	13.62-25.65	0.08	300	***		
L3CB	Μ	197	$28.42 \pm 0.171$	2.40	20.00-42.98	0.08				
L3CB	F	135	$27.32 \pm 0.209$	2.43	18.14–36.94	0.09	330	***		

Table 3. Interincisor and Intercanine Widths, mm

<sup>a</sup> 1 indicates central incisor; 2, lateral incisor; 3, canine; 4, first premolar; 5, second premolar; 6, first molar; 7, second molar; B, buccal; C, central; CV, coefficient of variation; D, distal; df, degrees of freedom; G, gingival; L, lingual; L, lower; M, mesial; Max, maximum; M-F, malefemale; Min, minimum; N, number; NS, not significant; SD, standard deviation; SE, standard error; \*, P < 0.05; and \*\*\*, P < 0.001.



**Figure 1.** Diagrammatic illustration of dental arch width measurement landmarks. See Tables 1 and 2 for definitions of reference points and landmarks.



**Figure 2.** Diagrammatic illustration of dental arch width measurement landmarks. See Tables 1 and 2 for definitions of reference points and landmarks.

Table 4. Inter-First Premolar Widths (mm)

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Landmarks <sup>a</sup>	Sex	Nª	Mean $\pm$ SE <sup>a</sup>	SDª	Min-Max <sup>a</sup>	CVa	dfa	P Value (M-F) <sup>a</sup>
Tooth 14-24								
U5MC	М	204	$43.52 \pm 0.170$	2.43	37.36-49.72	0.06		
U5MC	F	130	$41.93 \pm 0.215$	2.45	34.64-48.66	0.06	332	***
U4MC	Μ	205	$38.37 \pm 0.169$	2.42	30.99-48.66	0.06		
U4MC	F	129	$37.23 \pm 0.204$	2.32	31.52-45.18	0.06	332	***
U4CL	M	203	$32.74 \pm 0.165$	2.36	25.72-40.36	0.08		
U4CL	F	129	$31.79 \pm 0.214$	2.43	24.20-39.34	0.08	330	***
U4CG	Μ	202	$29.65 \pm 0.145$	2.06	22.61-34.96	0.07		
U4CG	F	129	$28.62 \pm 0.199$	2.25	21.07-35.64	0.08	329	***
U4CB	M	202	44.43 ± 0.163	2.30	38.10-51.26	0.05		
U4CB	F	132	$42.83 \pm 0.365$	4.19	34.36-55.92	0.10	183	***
Tooth 34-44								
L4CC	Μ	196	32.83 ± 0.147	2.06	27.38-38.85	0.06		
L4CC	F	131	$31.57 \pm 0.174$	1.99	25.23-37.04	0.06	325	***
L4CL	Μ	194	$29.48 \pm 0.150$	2.09	24.55-39.94	0.07		
L4CL	F	130	$28.11 \pm 0.189$	2.15	16.87–33.73	0.08	322	***
L4CG	M	195	$27.63 \pm 0.156$	2.19	23.52-39.30	0.08		
L4CG	F	124	$26.37 \pm 0.155$	1.73	21.39-31.21	0.07	302	***
L4CB	M	196	$36.59 \pm 0.198$	2.77	29.21-49.65	0.08		
L4CB	F	129	$35.11 \pm 0.221$	2.52	27.20-46.88	0.07	324	***
L4MC	Μ	200	$30.91 \pm 0.132$	1.87	26.02-37.56	0.06		
L4MC	F	133	$29.84 \pm 0.178$	2.05	22.38-39.94	0.07	331	***

<sup>a</sup> 1 indicates central incisor; 2, lateral incisor; 3, canine; 4, first premolar; 5, second premolar; 6, first molar; 7, second molar; B, buccal; C, central; CV, coefficient of variation; D, distal; df, degrees of freedom; G, gingival; L, lingual; L, lower; M, mesial; Max, maximum; M-F, malefemale; Min, minimum; N, number; NS, not significant; SD, standard deviation; SE, standard error; and \*\*\*, *P* < 0.001.

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Landmarks <sup>a</sup>	Sex	N <sup>a</sup>	Mean ± SE <sup>a</sup>	SDª	Min-Max <sup>a</sup>	CV <sup>a</sup>	dfª	P Value (M-F)
Tooth 15-25								
U6MC	М	216	47.85 ± 0.182	2.67	40.84-59.10	0.06		
U6MC	F	132	$45.97 \pm 0.223$	2.56	39.74-54.24	0.06	346	***
U5CC	Μ	184	$43.85 \pm 0.183$	2.49	36.98-51.56	0.06		
U5CC	F	120	$42.75 \pm 0.219$	2.40	37.40-51.63	0.06	302	***
U5CL	Μ	186	$38.49 \pm 0.199$	2.72	31.54-49.24	0.07		
U5CL	F	114	$37.43 \pm 0.226$	2.42	32.36-46.54	0.06	298	***
U5CG	Μ	183	$34.96 \pm 0.177$	2.40	25.36-41.08	0.07		
U5CG	F	116	$34.08 \pm 0.206$	2.22	29.34-41.18	0.07	297	***
U5CB	Μ	183	$50.18 \pm 0.191$	2.58	41.55-57.28	0.05		
U5CB	F	116	$49.04 \pm 0.275$	2.96	40.90-59.54	0.06	297	***
Tooth 35-45								
L6MC	Μ	210	41.63 ± 0.187	2.71	30.51-49.68	0.07		
L6MC	F	129	$40.07 \pm 0.209$	2.38	28.79-48.97	0.06	337	***
L5CC	Μ	173	$38.18 \pm 0.289$	3.80	32.81-46.02	0.10		
L5CC	F	112	$37.17 \pm 0.208$	2.20	31.58-42.76	0.06	280	***
L5CL	Μ	177	$33.74 \pm 0.174$	2.31	27.46-39.09	0.07		
L5CL	F	112	$32.60 \pm 0.220$	2.33	27.10-39.19	0.07	287	***
L5CG	Μ	112	$32.25 \pm 0.157$	2.09	26.52-38.40	0.06		
L5CG	F	110	$30.97 \pm 0.199$	2.09	24.96-36.14	0.07	285	***
L5MC	Μ	195	$36.74 \pm 0.243$	3.39	30.03-42.80	0.09		
L5MC	F	130	$35.61 \pm 0.217$	2.47	29.82-48.92	0.07	320	***
L5CB	Μ	111	$41.94 \pm 0.191$	2.54	34.54-48.84	0.06		
L5CB	F	115	$40.46 \pm 0.230$	2.46	34.65-49.00	0.06	290	***

Table 5. Inter-Second Premolar Widths (mm)

<sup>a</sup> 1 indicates central incisor; 2, lateral incisor; 3, canine; 4, first premolar; 5, second premolar; 6, first molar; 7, second molar; B, buccal; C, central; CV, coefficient of variation; D, distal; df, degrees of freedom; G, gingival; L, lingual; L, lower; M, mesial; Max, maximum; M-F, malefemale; Min, minimum; N, number; NS, not significant; SD, standard deviation; SE, standard error; and \*\*\*, *P* < 0.001.

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The diet of the Southern Chinese population is similar to that of persons in Southeast Asia, with the staple component of refined rice. This is different from the Northern Chinese population, for whom the major carbohydrate intake is wheat. Further study is needed to investigate the association between diet and dental arch width within different populations.

Comparisons of data on dental arch dimensions from different studies are hampered by the fact that it is not easy to tabulate all data on different landmarks. Moreover, different authors chose different sample groups for measurement. It has also been shown that individual dental arch dimensions change with age.<sup>1,6,9,19,27-34</sup> This study uses definitions for dental widths that allow different studies to be compared.

Comparisons of dental arch width at the canines between Southern Chinese and various other populations (Tables 8 and 9) show that the Southern Chinese occupy the highest position when ranked in order against the quoted literature. It is interesting to note that Chinese dental arches appear to be very wide compared with those of white populations, with an intercanine width difference of about 3 mm in the maxilla and 2 mm in the mandible.

Table 10 shows that the interpremolar width of the

Figure 3. Diagrammatic illustration of dental arch width measurement landmarks. See Tables 1 and 2 for definitions of reference points and landmarks.

Table 6. Inter-First Molar Widths (mm)

Landmarks <sup>a</sup>	Sex <sup>a</sup>	Na	$\text{Mean}\pm\text{SE}^{a}$	SDª	Min-Max <sup>a</sup>	CVa	dfa	P Value (M-F)ª
Tooth 16–26								
U7MC	Μ	209	52.50 ± 0.195	2.81	45.00-63.89	0.05		
U7MC	F	133	50.50 ± 0.241	2.78	37.33-59.40	0.06	340	***
U6CC	М	207	49.20 ± 0.188	2.70	42.47-61.00	0.05		
U6CC	F	127	$47.20 \pm 0.320$	3.61	17.56-55.39	0.08	212	***
U6ML	М	207	42.30 ± 0.181	2.60	36.05-55.54	0.06		
U6ML	F	128	$40.75 \pm 0.241$	2.72	31.01-49.92	0.07	333	***
U6MG	М	211	$36.19 \pm 0.190$	2.76	29.15-47.08	0.08		
U6MG	F	131	$35.13 \pm 0.245$	2.80	27.56-46.90	0.08	272	***
U6DL	Μ	208	$44.22 \pm 0.193$	2.79	35.05-57.90	0.06		
U6DL	F	125	$42.34 \pm 0.209$	2.33	37.20-49.64	0.06	297	***
U6DB	Μ	209	56.17 ± 0.191	2.76	49.70-68.44	0.05		
U6DB	F	130	$54.15 \pm 0.220$	2.56	46.56-63.99	0.05	337	***
U6CB	Μ	210	56.06 ± 0.197	2.85	47.38-68.18	0.05		
U6CB	F	129	53.98 ± 0.221	2.52	46.44-61.90	0.05	337	***
U6MB	Μ	208	$54.54 \pm 0.200$	2.93	43.52-65.70	0.05		
U6MB	F	130	$52.63 \pm 0.227$	2.59	43.57–59.58	0.05	336	***
Tooth 36-46								
L7MC	М	208	47.24 ± 0.187	2.69	40.68-58.06	0.06		
L7MC	F	129	45.46 ± 0.183	2.08	39.48-50.04	0.05	320	***
L7CC	М	190	43.37 ± 0.173	2.39	36.72-53.70	0.06		
L7CC	F	118	41.83 ± 0.213	2.31	33.75-49.98	0.06	306	***
L6DL	М	211	$36.19 \pm 0.190$	2.76	16.96-47.08	0.08		
L6DL	F	123	$36.68 \pm 0.202$	2.24	28.50-45.58	0.06	320	***
L6ML	Μ	200	$36.09 \pm 0.183$	2.59	29.20-48.78	0.07		
L6ML	F	123	$34.82 \pm 0.192$	2.13	28.46-43.11	0.06	321	***
L6MG	Μ	202	$34.40 \pm 0.191$	2.72	20.51-47.23	0.08		
L6MG	F	123	$33.28 \pm 0.183$	2.03	25.86-41.52	0.06	310	***
L6MB	Μ	201	$46.19 \pm 0.280$	3.98	14.79-58.34	0.09		
L6MB	F	124	$44.85 \pm 0.203$	2.25	37.42-52.75	0.05	321	***
L6CB	Μ	196	$48.11 \pm 0.247$	3.36	28.21-64.96	0.07		
L6CB	F	123	46.73 ± 0.191	2.12	41.07-54.64	0.05	317	***
L6DB	Μ	201	$49.25 \pm 0.298$	4.23	38.54-60.22	0.09		
L6DB	F	122	47.82 ± 0.188	2.08	42.33–55.60	0.04	310	***

<sup>a</sup> 1 indicates central incisor; 2, lateral incisor; 3, canine; 4, first premolar; 5, second premolar; 6, first molar; 7, second molar; B, buccal; C, central; CV, coefficient of variation; D, distal; df, degrees of freedom; G, gingival; L, lingual; L, lower; M, mesial; Max, maximum; M-F, malefemale; Min, minimum; N, number; NS, not significant; SD, standard deviation; SE, standard error; and \*\*\*, *P* < 0.001.

Southern Chinese was wider than that of the Chinese who were living in Liverpool.<sup>38,39</sup> Both the Chinese from the present study and those from Liverpool were significantly wider than a white population by about 2 to 3 mm at the interpremolar width.<sup>39</sup> When compared with Taiwan Chinese at the interpremolar width at the buccal cusp tips, the Southern Chinese were marginally larger (Table 11).<sup>40</sup>

The maxillary intermolar widths at the distobuccal cusps of the first molars of the Southern Chinese were wider than those of Caucasians<sup>6,35</sup> in both sexes. The Australian Aboriginals were widest in the mandibular intermolar width at the distobuccal cusps of the first molars (Table 12). Taiwan Chinese<sup>42</sup> were wider than Southern Chinese at the mandibular intermolar width at the distobuccal cusps of the mandibular first molars by about 1.3 mm in both sexes (Table 12). Table 13 demonstrated that Taiwan Chinese intermolar widths were wider than those of Southern Chinese by 1.1 mm and 1.8 mm for males and females, respectively.<sup>42</sup>

Both the Southern Chinese and the Taiwan Chinese had much wider intersecond molar widths at the distobuccal cusp in both sexes when compared with the Swedes (Table 14).<sup>1,42</sup> The Taiwan Chinese intersecond molar widths were wider than were those of the Southern Chinese.

It is important to note that the comparisons of dental arch width measurements among different populations discussed earlier in this article show very large standard deviations of around 2 to 3 mm. Statistical testing of the data between studies is needed to determine whether differences are significant.

In addition to population study data on dental arch width, this study provides a database by which various related studies involving arch widths can be compared. For example, Poosti and Jalali<sup>43</sup> related tooth size and arch dimension using the definitions of lingual and buccal intercanine widths. This can be related to our data by applying the results from the lingual areas and buccal cusps as landmarks. Studies from Isik et al<sup>44</sup> and Huth et al<sup>45</sup> compared the arch widths between Class II division I and division 2 malocclusions. They used the buccal cusps as landmarks for intercanine and intermolar widths. These can be compared with our data, in which the buccal cusps are used as landmarks.

 Table 7.
 Inter–Second Molar Widths (mm)

Landmarksª	Sex	Na	$\text{Mean}\pm\text{SE}^{a}$	SDª	Min-Max <sup>a</sup>	CVa	dfa	P Value (M-F) <sup>a</sup>
Tooth 17-27								
U7CC	М	64	$53.84 \pm 0.339$	2.71	47.16-60.86	0.05		
U7CC	F	60	$51.72 \pm 0.302$	2.35	46.80-56.71	0.05	122	***
U7ML	М	71	47.66 ± 0.420	3.54	38.98-61.60	0.07		
U7ML	F	62	45.78 ± 0.310	2.44	40.10-50.75	0.05	125	***
U7MG	М	56	$42.17 \pm 0.424$	3.17	36.79-50.63	0.08		
U7MG	F	54	$40.33 \pm 0.288$	2.12	34.93-45.29	0.05	108	***
U7DL	М	34	$49.03 \pm 0.510$	2.98	41.03-54.50	0.06		
U7DL	F	33	48.21 ± 0.527	3.03	42.36-54.63	0.06	65	NS
U7DC	Μ	37	$54.94 \pm 0.540$	3.28	47.62-61.18	0.06		
U7DC	F	51	52.91 ± 0.416	2.97	46.82-59.71	0.06	86	**
U7DB	Μ	52	59.68 ± 0.432	3.11	51.48-67.34	0.05		
U7DB	F	57	$57.64 \pm 0.384$	2.90	50.62-63.67	0.05	107	***
U7CB	Μ	57	$60.54 \pm 0.380$	2.87	52.60-66.32	0.05		
U7CB	F	57	$58.04 \pm 0.382$	2.88	48.08-63.00	0.05	112	***
U7MB	Μ	67	$60.17 \pm 0.350$	2.87	52.40-66.77	0.05		
U7MB	F	60	$57.59\pm0.324$	2.51	51.88–63.30	0.04	125	***
Tooth 37-47								
L7CC	М	106	48.91 ± 0.260	2.67	41.66-57.96	0.05		
L7CC	F	87	46.94 ± 0.277	2.58	40.86-54.45	0.05	191	***
L7DL	Μ	75	$44.54 \pm 0.350$	3.01	37.69-51.57	0.07		
L7DL	F	61	$42.57 \pm 0.340$	3.01	37.69-51.57	0.07	134	***
L7DG	Μ	46	42.29 ± 0.380	2.56	36.37-46.98	0.06		
L7DG	F	46	$40.51 \pm 0.430$	2.94	26.98-44.90	0.07	90	**
L7ML	Μ	105	42.10 ± 0.274	2.81	35.02-50.18	0.07		
L7ML	F	88	$40.62 \pm 0.255$	2.39	35.04-46.50	0.06	191	***
L7MG	Μ	94	40.23 ± 0.262	2.54	35.04-48.50	0.06		
L7MG	F	74	$38.88 \pm 0.234$	2.01	34.33-45.12	0.05	166	***
L7MB	Μ	112	51.48 ± 0.296	3.14	43.32-62.07	0.06		
L7MB	F	95	$49.56 \pm 0.300$	2.92	42.20-56.57	0.06	205	***
L7CB	Μ	105	53.71 ± 0.293	3.00	45.92-63.02	0.06		
L7CB	F	89	51.56 ± 0.297	2.80	45.19-58.52	0.05	192	***
L7DB	Μ	94	54.39 ± 0.310	3.01	46.03-63.64	0.06		
L7DB	F	86	$52.03 \pm 0.330$	2.95	45.68-59.11	0.06	172	***
L7DC	М	57	51.81 ± 0.483	3.65	38.34-58.68	0.07		
L7DC	F	48	$49.54 \pm 0.375$	2.59	43.77-53.80	0.05	103	***

<sup>a</sup> 1 indicates central incisor; 2, lateral incisor; 3, canine; 4, first premolar; 5, second premolar; 6, first molar; 7, second molar; B, buccal; C, central; CV, coefficient of variation; D, distal; df, degrees of freedom; G, gingival; L, lingual; L, lower; M, mesial; Max, maximum; M-F, malefemale; Min, minimum; N, number; NS, not significant; SD, standard deviation; SE, standard error; \*\*, P < 0.01; and \*\*\*, P < 0.001.

Table 8. Comparison of Intercanine Widths (Cu	usp to Cusp) in Various Populations
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		Males				
Tooth 13–23	Nª	Mean $\pm$ SE <sup>a</sup>	SDª	Nª	$\text{Mean}\pm\text{SE}^{a}$	SDª
Southern Chinese Ling (present study)	166	36.92 ± 0.23	2.9	124	35.09 ± 0.32	3.5
Taiwan Chinese <sup>35</sup>	50	$35.12 \pm 0.37$	2.6	42	$34.88 \pm 0.25$	1.6
Caucasians (American) <sup>31</sup>	15	$33.62 \pm 0.52$	2.1	13	$32.54 \pm 0.50$	2.1
Caucasians <sup>33</sup>	60	34.05	2.1	83	32.77	2.2
Caucasians (British)36	50	31.54	2.6	49	30.55	2.2
Arabs (Saudi)37	71	35.43	1.6	68	33.69	1.0
Tooth 33–43						
Southern Chinese Ling (present study)	197	28.42 ± 0.17	2.4	135	27.32 ± 0.21	2.4
Caucasians (American) <sup>31</sup>	16	25.75 ± 0.41	1.63	15	$24.59 \pm 0.39$	1.5
Caucasians <sup>33</sup>	61	26.10	1.8	88	2.65	1.9

<sup>a</sup> N indicates number; SD, standard deviation; and SE, standard error.

It is of interest to relate dental arch width to the prevalence of respiratory disease. Epidemiologic surveys have shown that the prevalence of asthma in Asian populations is relatively low. Within the Chinese population, schoolchildren from Hong Kong were found to have the highest incidence of asthma. Wong et al<sup>46</sup> studied the prevalence of respiratory and atopic disorders and the role of atopy in the development of asthma in Chinese schoolchildren from Hong Kong, Beijing, and Guangzhou. Using a standardized written questionnaire (n = 10,902), along with a skin prick test (n = 3479) and a skin exami-

#### DENTAL ARCH WIDTHS

Table 9.	Comparison of	Intercanine Widths	(Deepest Point	Internally) in	Various Populations
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		Males		Females			
Tooth 13–23	Nª	$\text{Mean}\pm\text{SE}^{\text{a}}$	SDª	N <sup>a</sup>	$\text{Mean}\pm\text{SE}^{a}$	SDª	
Southern Chinese Ling (present study)	153	27.33 ± 0.15	1.8	121	26.10 ± 0.17	1.8	
Chinese in Liverpool <sup>38</sup>	49	26.08	1.7	56	25.36	1.9	
Caucasians (British)39	71	24.71	2.2	78	23.52	1.7	
Caucasians (Finns) <sup>11</sup>	b	26.6	1.8	b	25.1	1.9	
Australian Aboriginals7	4	$26.0\pm1.5$	3.0	4	$28.0\pm1.5$	3.0	

<sup>a</sup> N indicates number; SD, standard deviation; and SE, standard error.

 $^{b}$  n = 251, but sex is not specified.

Table 10. Comparison of Interpremolar Widths (Fissure) in Various Popula	ations
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		Males		Females			
Tooth 14–24	N <sup>a</sup>	Mean $\pm$ SE <sup>a</sup>	SDª	N <sup>a</sup>	Mean $\pm$ SE <sup>a</sup>	SDª	
Southern Chinese							
Ling (present study) Chinese in Liverpool <sup>35</sup> Caucasians (British) <sup>36</sup>	205 48 71	$\begin{array}{r} 38.37  \pm  0.17 \\ 37.63 \\ 35.44 \end{array}$	2.4 2.2 3.4	129 50 78	$\begin{array}{r} 37.26\ \pm\ 0.20\\ 36.41\\ 33.55\end{array}$	2.3 1.9 0.24	

<sup>a</sup> N indicates number; SD, standard deviation; and SE, standard error.

Table 11. Comparison of Interpremolar Widths (Buccal Cusp Tips) Between 12-Year-Old Southern Chinese and Taiwan Chinese

		Males		Females		
Tooth 14–24	Nª	$\text{Mean}\pm\text{SE}^{a}$	SD <sup>a</sup>	Ν	$\text{Mean}\pm\text{SE}^{a}$	SDª
Southern Chinese Ling (present study) Taiwan Chinese Hong <sup>37</sup>	202 58	$\begin{array}{r} 44.43\pm0.16\\ 43.45\end{array}$	2.3	132 55	$\begin{array}{r} 42.83 \pm 0.37 \\ 42.69 \end{array}$	4.2

<sup>a</sup> N indicates number; SD, standard deviation; and SE, standard error.

#### Table 12. Comparison of Inter-First Molar Widths (Distal Buccal Cusp) in Various Populations

	Males			Females		
Tooth 16–26	Nª	$\text{Mean}\pm\text{SE}^{a}$	SDª	Nª	$\text{Mean}\pm\text{SE}^{\text{a}}$	SDª
Southern Chinese Ling (present study)	209	56.17 ± 0.19	2.8	130	54.15 ± 0.22	2.6
Egyptians43	50	54.60	2.9	50	53.75	2.7
Swedes Seipel <sup>1</sup>	215	$46.44 \pm 0.19$	2.8	203	$44.90 \pm 0.19$	2.7
Caucasians (British)43	64	52.35	3.2	49	50.61	2.9
Caucasians <sup>33</sup>	56	45.59	2.5	77	44.28	2.1
Tooth 36–46						
Southern Chinese Ling (present study)	201	$49.25 \pm 0.30$	4.2	122	$47.82 \pm 0.19$	2.1
Taiwan Chinese <sup>39</sup>	45	$50.60 \pm 0.41$	2.8	38	$49.13 \pm 0.43$	2.6
Australian Aboriginals41	39	51.49	3.2	20	48.34	2.2
Swedes <sup>1</sup>	185	$47.02 \pm 0.19$	2.4	118	$41.83 \pm 0.21$	2.3
Caucasians <sup>33</sup>	58	$42.84\pm2.6$	2.6	84	41.60	2.4

<sup>a</sup> N indicates number; SD, standard deviation; and SE, standard error.

 Table 13.
 Comparison of Inter-First Molar Widths (Mesial Fossa) Between 12-Year-Old Southern Chinese and Taiwan Chinese

	Males			Females		
Tooth 16–26	Nª	$\text{Mean}\pm\text{SE}^{a}$	SDª	Nª	$\text{Mean}\pm\text{SE}^{\text{a}}$	SDª
Southern Chinese Ling (Present Study) Taiwan Chinese <sup>39</sup>	207 47	$\begin{array}{r} 49.20\pm0.19\\ 50.30\pm0.39\end{array}$	2.7 2.7	127 44	$\begin{array}{r} 47.20\pm0.32\\ 48.01\pm0.39\end{array}$	3.6 2.6

<sup>a</sup> N indicates number; SD, standard deviation; and SE, standard error.

	Males			Females		
Tooth 17–27	Na	Mean $\pm$ SE <sup>a</sup>	SDª	Nª	$\text{Mean}\pm\text{SE}^{a}$	SDª
Central Fossae						
Southern Chinese Ling (present study)	64	$53.84 \pm 0.34$	2.7	60	51.71 ± 0.30	2.4
Taiwan Chinese <sup>39</sup>	49	$55.15 \pm 0.42$	2.9	43	$52.90 \pm 0.45$	2.9
Swedes <sup>1</sup>	149	$51.62 \pm 0.22$	2.7	172	$49.75\pm0.22$	2.9
Mandibular Arch Width Tooth 37-47 Distob	uccal Cusps					
Southern Chinese Ling (present study)	94	$54.39 \pm 0.31$	3.0	80	$52.03 \pm 0.33$	3.0
Taiwan Chinese <sup>39</sup>	47	$55.22 \pm 0.46$	3.1	39	$53.00\pm0.49$	3.1
Swedes Seipel <sup>1</sup>	164	$52.66 \pm 0.21$	2.7	175	$51.03 \pm 0.21$	2.1

Table 14. Comparison of Inter–Second Molar Widths (Central Fossae of M2–M2 and Distobuccal Cusps of M2–M2) in Various Populations

<sup>a</sup> N indicates number; SD, standard deviation; and SE, standard error.

nation (n = 3479), they found that the prevalence of current wheeze, speech limiting wheeze, rhinoconjunctivitis, and flexural dermatitis was significantly greater in Hong Kong than in Beijing or Guangzhou. The atopy rate was also higher in Hong Kong (41.2%) than in Beijing (23.9%) or Guangzhou<sup>46</sup> (30.8%). Further study is needed to investigate the association between the prevalence of respiratory disease and arch widths in this population.

# CONCLUSIONS

- This study yielded a database about dental arch widths with different definitions by which different studies can be compared.
- The Southern Chinese may have been characterized by a wider dental arch width when compared with whites, but variations were extensive.
- All male maxillary and mandibular arch widths in the Southern Chinese were significantly larger than female arch widths, except in the incisor regions. The hypothesis "There were no differences in dental arch widths between males and females in Southern China" was rejected.

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