

The Dental Traits of Indonesian Javanese

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ABSTRACT This study describes the dental crown morphology of 91 Javanese of known sex and age, in Surabaya, East Java. The purpose was to explore the dental morphology in the area of East Java, especially in Surabaya. I scored a battery of three dozen dental traits on the permanent dentition (sexes pooled). Comparisons of

the trait frequencies show that this Javanese sample does not exhibit a classic combination either of the Sinodont or Sundadont dental patterns. Instead, it represents some features of each, and this probably is due to the millennia of human migrations through this region. *Dental Anthropology* 2010(23):74-78.

The dental morphology of Southeast Asia is poorly known. Studies in dental anthropology have never been conducted on Indonesians even though the area has a rich variety of peoples and cultures. Data on the variety of populations in this area may be useful regarding human evolution (Hillson, 2002), migration patterns (Scott and Turner, 2000), and for evaluating forensic cases (Brown, 1992). Previous studies have assessed menarcheal age (Artaria and Henneberg, 2000), mesiodistal diameters of the primary dentition (Kuswandari and Nishino, 2004), and adolescents' growth and development (Artaria, 2009), but little has been found on the characteristics of the dentition in Javanese people, so it is useful to initiate studies of this kind.

Previous study on the Javanese dentition (Artaria, 2007) found that shovel shape, winging, tuberculum dentale, interruption groove, canine distal accessory ridge, premolar accessory ridges, premolar multiple lingual cusps, cusp 5, cusp 6, Y5 pattern, cusp 7, protostylid, deflecting wrinkle, anterior fovea, and Carabelli's cusp occurred in the sample. However, that preliminary sample size was small, and no scoring was done for each variable.

The literature suggest that dental variation is heritable, the traits appear to be controlled by multiple genes, and they are little influenced by environmental factors (Rodríguez-Flórez *et al.*, 2006), so phenotypic differences among samples can be interpreted as differences in genotypic composition (Varela and Cocilovo, 2000). Phenotypic similarity is suggested to approximate genetic similarity.

Research on the primary dentition of Javanese children (Kuswandari and Nishino, 2004) found that the mesiodistal tooth diameters fell between those of Australian Aboriginals and Hong Kong Chinese. This makes sense because Jacob (1967) and others note that the islands of Indonesia historically were occupied by ancient Homo sapiens similar to those of the Australians.

The teeth of the Javanese may reflect the admixture of two ancestral lines, namely Australomelanesid and Mongoloid.

The goal of the present research was to describe the frequencies of some common dental traits as they were represented in a contemporary sample of Javanese.

MATERIAL AND METHODS

The sample was 91 individuals from the Surabaya, East Java (Indonesia). The dental traits examined were shovel shape, double shovel, winging, tuberculum dentale, interruption groove, canine distal accessory ridges, Carabelli's cusp, odontomes, premolar accessory ridge, parastyle, multiple lingual cusps, Dryopithecus pattern, Cusp 5, Cusp 6, Cusp 7, deflecting wrinkle, anterior fovea, protostylid, and uncommon shape/place of lateral incisors. Dental traits were scored using the descriptions in Scott and Turner (2000), and the dental plaques provided by ASU. Percentages were counted using simple descriptive statistic analysis.

RESULTS AND DISCUSSION

Scott and Turner (2000) have divided the world's populations into five groups based on their dentitions. The dental traits of Sahul-Pacific group—the same area occupied by the Australomelanesid according to Jacob (1967)—exhibit dental characteristics such as frequent expression of cusp 5, Carabelli's cusp, and cusp 6. In contrast, there are rare expressions of winging, shoveling, double shoveling, interruption grooves, and cusp 7. Further, they have intermediate position for several

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traits such as odontomes, 4 cusped LM1 and LM2, LM2 Y pattern, and deflecting wrinkle.

The Sino-Americas group, according to Scott and Turner (2000) has characteristics of dentition such as high frequency of winging, double shoveling, interruption grooves, odontomes, cusp 6, and deflecting wrinkle. The Sunda Pacific groups have no high frequency dental traits that set them apart; however, they have high frequencies of Carabelli's cusp and cusp 6, and low frequencies of cusp 7 and 4-cusped LM1.

Shovel shape had been widely studied by several authors (e.g., Campusano *et al.*, 1972; Dahlberg, 1951; DeVoto *et al.*, 1968; Bollini *et al.*, 2006; Nelson, 1938; Rothhammer *et al.*, 1968). Most of these studies concluded that high frequency of strong shovel shaped incisors was found in Mongoloid populations, especially those descendants of Mongoloid people from the Asian continent. A study by Bollini *et al.* (2009) reported a high frequency of shovel shape (80%) but absence of Carabelli's complex in the Pre-Conquest sample "Calchaquí" from Argentina.

In the present sample, shovel shape was common, although the expressions were mostly grades 2 and 3 (Table 1) using the ASU shovel shape dental plaque. This is expected given the Asian ancestry of the group, especially the Sundadont. The most frequent degree of expression for upper first incisor and lateral incisors was 2. It was also noteworthy that the frequency of the sample that did not have shoveled-shape upper incisors was comparatively high—8% to 9% (Table 1). These frequencies for shoveling suggest similarities to the Sunda Pacific group.

Some subjects have slight double shovel (Table 1). The frequency of double shovel in recent Southeast Asia predicted by Scott and Turner (2000) is 5% to 18%. However, this higher frequency in these Javanese may reflect admixture of the Surabayan people in the coastal

TABLE 1. Percentages of shovel and double shovel shape[†]

Grade	Shovel		Shovel lower I and C	Double shovel	
	UI1	UI2		UI1	UI2
0	8.8	7.7	62.3	26.2	53.3
1	8.8	24.2	27.9	57.4	38.3
2	40.7	30.8	8.2	14.8	7.4
3	24.2	17.6	1.6	1.6	0.0
4	9.9	13.2	0.0	0.0	0.0
5	7.7	3.3	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0
7	0.0	2.2	0.0	0.0	0.0
Missing	0.0	1.0	0.0	0.0	1.0
Total	100.0	100.0	100.0	100.0	100.0

[†]UI1: upper central incisor, UI2: upper lateral incisor, I: incisor, C: canine

TABLE 2. Percentage of tuberculum dentale (TD), interruption groove (IG), maxillary incisor winging, and uncommon shape/place of lateral incisors (LI)

Grade	TD	IG	Winging	LI Shape
0	47.3	86.7	84.6	0.0
1	18.7	12.3	7.7	0.0
2	24.2	0.0	5.5	0.0
3	3.3	0.0	2.2	0.0
Absent	0.0	0.0	0.0	98.3
Present	0.0	0.0	0.0	1.7
Missing	0.0	1.0	0.0	0.0
Total	100.0	100.0	100.0	100.0

area of northeast Java with the Sinodont-people from Asia who migrated to the Indonesian areas during the first to second centuries. Double shovel was found in the upper central incisors in 73% of the sample, but only in a weak expression, scores 1 to 3, and 47% of the sample had double shovel of their lateral incisors. Double shoveling frequency is similar to that of the Sunda Pacific group.

High frequencies of winging are usually found in Sinodont dentitions, especially groups in northeast Siberia and North America. The people of Java are labeled Sundadont, and some data suggest that Sundadont groups may also have high frequencies of winging. The Sunda Pacific group is suggested to exhibit winging on the order of 15% to 28% (Scott and Turner, 2000). Incisor winging occurred in 15% of the present sample (Table 2), so it is comparable to the Sunda Pacific group as described by Scott and Turner.

Expression of tuberculum dentale was weak to moderate, and most individuals—47%—lacked tuberculum dentale on their central incisors (Table 2). Only 3% exhibited a more pronounced—score 3—grade of tuberculum dentale. This is neither characteristic of Sino Americas nor Sahul Pacific, but more like that of Sunda Pacific groups.

According to Scott and Turner (2000), the Sunda-Pacific people—including Southeast Asians—have frequencies of 25% to 35% with interruption grooves on the second incisors. However, interruption grooves on the upper second incisors occurred in only 12% of the current sample (Table 2). This low frequency of interruption grooves is more similar to Sahul Pacific groups.

Upper lateral incisors can undergo rotation, crowding, or reduced size (Table 2), and the uncommon shape or placement of lateral incisors occurred in a small number of the sample (2%). Instead of having uncommon shape/size of lateral incisors—as is more common in Caucasian samples, Mongoloids seem to have more cases of winging of central incisors (C. G. Turner, pers. comm.).

No Bushmen canine was found in the sample. Canine distal accessory ridge occurred in 69% of the sample (Table 3). The occurrence of distal accessory ridges on

TABLE 3. Percentages of distal accessory ridge (DAR) and the Bushmen canine[†]

Score	DAR UC	DAR LC	Bushmen UC
0	31.1	88.5	100.0
1	49.2	11.5	0.0
2	19.7	0.0	0.0
Missing	0.0	0.0	0.0
Total	100.0	100.0	100.0

[†]U = upper, L = lower, C = canine

the lower canine was less common (12% of the sample). Research is needed to find out whether there is sexual dimorphism in this particular trait.

There was an indication of sexual dimorphism—males having larger cusps—for Carabelli's trait (Khraisat *et al.*, 2007). According to Mavrodisz *et al.* (2007), there is a genetic influence on the Carabelli's trait. There also is a positive association between Carabelli's cusp and tooth crown size (Garn *et al.*, 1966; Harris, 2007). Carabelli's trait complex was expressed in more than 70% of the cases (Table 4), with the degree of expression ranging from 0 to 7. The high percentage of Carabelli's cusp is the characteristic of both Sunda Pacific and Sahul Pacific. However, according to Scott and Turner (2000), the percentage may reach 25%, but not as high as 70%. This outstanding occurrence of Carabelli's cusp may be related to some other factors, such as the size of the tooth crown (Harris, 2007) or sampling fluctuation. Further research in this matter may be conducted in the near future.

The parastyle occurred on 2% (M3) to 6% (M2) of the molars, while no parastyle nor cusp 5 was found on M1 (Table 4). The absence of cusp 5 certainly is not a characteristic of Sahul Pacific groups; it is more characteristic of Sino Americans according to Scott and Turner (2000).

The groove pattern was mostly of the X pattern (Table

5). The Dryopithecus pattern (Y pattern LM2) was found in 7% of the sample. The frequency of the Y pattern of Australians (Sahul Pacific group) is approximately 21%. The percentage of Y pattern on LM2 in China Mongolia and North and South America (Sino Americas group) is around 8-9%, and in the Sunda Pacific is around 19% (Scott and Turner, 2000), so the percentage of the Y pattern in this sample was closer to the Sino American condition.

Cusp 6 was found in 6% of the sample, and no cusp 7 was found (Table 5). The closest percentage of cusp 6 occurrence was the New Guinea people (Sahul Pacific) that has around 18% of people with the dental trait. The south Siberian (Sino American group) has 20%, and the Southeast Asians (Sunda Pacific group) 32% (Scott and Turner, 2000). Cusp 7 is a common characteristic in Sub-Saharan peoples, while low frequencies (0-10%) generally occur in the Sino Americas, Sahul Pacific, and Sunda Pacific groups (Scott and Turner, 2000), so this accessory cusp is, not surprisingly, absent in this Javanese sample.

Most of the sample (above 90%) had no deflecting wrinkle or anterior fovea (Table 5). Deflecting wrinkle was found in 3%, and anterior fovea was in 7% of the sample. The closest percentage of deflecting wrinkle was found in the New Guinean people—around 5% of the people. The recent Southeast Asian (Sunda Pacific group) has 15%, and other Sino Americas around 30% and above (Scott and Turner, 2000).

The protostylid occurred predominately on M1, with a frequency above 50% (Table 5). Similar to the Carabelli cusp, the protostylid also is positively associated with crown size (Scott and Turner, 2000). Further they stated that the protostylid was frequently expressed on LM1—which was true for this sample, but when it appeared on LM2 the size often was bigger.

Accessory ridge was found in 10% to 29% of the upper premolars in the sample (Table 6), while the percentage of sample having accessory ridges on the lower premolars was even less, namely 1-2% (Table 7) as expected. There were no odontomes (Table 6 and 7), although Scott and Turner (2000) estimated that 1 to 4% of recent Southeast

TABLE 4. Trait percentages on the upper molars[†]

Score	UM1C	UM2C	UM1C5	UM1PA	UM2PA	UM3PA
0	20.9	71.4	100.0	100.0	93.3	17.6
1	40.7	15.4	0.0	0.0	5.6	2.2
2	20.9	12.1	0.0	0.0	0.0	0.0
3	9.9	0.0	0.0	0.0	0.0	0.0
4	2.2	0.0	0.0	0.0	0.0	0.0
5	2.2	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0
7	3.3	0.0	0.0	0.0	0.0	0.0
Missing	0.0	1.1	0.0	0.0	1.1	80.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

[†]U = upper, M = molar, C = Carabelli's cusp, C5 = cusp 5, PA = parastyle

TABLE 5. Percentage of traits in lower molars†

Score	LM2GP	LM1C6	LM1C7	LM1DW	LM1AF	LM1PO	LM2PO	LM3PO
0	24.6	94.3	100.0	96.2	92.6	47.3	65.6	13.2
1	6.6	5.7	0.0	3.8	7.4	52.7	34.4	4.4
2	65.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Missing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	82.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

†L=lower, M=molar, GP=groove pattern, score 0: unclear groove/missing tooth, score 1: Dryopithecus pattern, score 2: X pattern, score 3: + pattern; C6=cusp 6, C7=cusp 7, DW=deflecting wrinkle, AF=anterior fovea, PO = protostylid

Asian people have odontomes. Multiple lingual cusps were found mostly on the lower second premolar. The cusps were also more complicated on the second lower premolars (Table 7).

CONCLUSION

Based on the finding in this Javanese sample, the trait frequencies were more like Sunda Pacific. The Sundadont people who have higher frequency of derived traits are thought to have evolved on Sundaland during Upper Pleistocene. They exhibit a “more conservative pattern, typified by trait retention rather than elaboration” (Scott and Turner, 2000). The traits with frequencies similar to the Sunda Pacific group were shoveling, double shovel, winging, and tuberculum dentale.

However, other percentages mirror those of the Sino Americas, and still others those of Sahul Pacific. Trait frequencies similar to Sino Americas were cusp 5 and the Y pattern. Percentages similar to Sahul Pacific were interruption grooves, cusp 6, and deflecting wrinkle. Consequently, this sample of Javanese is not monolithic as regards either the Sinodont or Sundadont dental patterns. Instead, they exhibit some features of each, probably because of the millennia of human migrations through this region.

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TABLE 6. The percentage of traits in upper premolars†

Score	UP1AR	UP2AR	UP1OD	UP2OD
0	90.0	71.4	100.0	100.0
1	10.0	28.6	0.0	0.0
Missing	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0

†U = upper, P = premolar, AR = accessory ridge, OD = odontome

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TABLE 7. Trait percentage on the lower premolars[†]

Score	LP1AR	LP2AR	LP1OD	LP2OD	LP1MLC	LP2MLC
0	98.4	98.3	100.0	100.0	94.8	36.2
1	1.6	1.7	0.0	0.0	5.2	37.9
2	0.0	0.0	0.0	0.0	0.0	22.4
3	0.0	0.0	0.0	0.0	0.0	3.4
Missing	0.0	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

[†]L = lower, P = premolar, AR = accessory ridge, OD = odontome, MLC = multiple lingual cusps

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