Research Article

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A Study to Evaluate Non-Metric Dental Traits among an Ethnically Mixed Population from Vadodara

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ABSTRACT

Aim: To evaluate the frequency and variability of non-metric parameters in the human dentition of an ethnically mixed population residing in Vadodara, Gujarat.

Materials & Method: The study was conducted on a total of 100 students of B. D. S and M.D.S course at K. M. Shah Dental College and Hospital, Piparia between 18 to 25 years of age with a caries free dentition having a healthy periodontium. Impressions of both arches were made for participants with irreversible hydrocolloid (alginate) and casts were observed under a stereomicroscope to evaluate 17 different morphological traits.

Results: Traits such as hypocone, premolar lingual cusp variation and metaconulid showed a statistically significant variation among Gujarati and non-Gujarati population whereas winging, shovelling and canine mesial ridge showing significant sexual dimorphism.

Keywords: Dentistry, non-metric dental traits, Vadodara.

INTRODUCTION

Teeth are informative indicators for the study of human populations, as dental morphology serves as bases for comparisons of genetic origin, hence allowing for the classification of human groups in taxonomic, phylogenetic and evolutionarily categories by means of their frequency, sexual dimorphism, bilateral symmetry and morphological characteristics.[1]

This is possible because dental morphology is expressed to be genetically unique and unrepeatable in each tooth. The tooth structure formed histo-embryologically does not change or remodel itself as with the bone, excluding mechanical wear or attrition and accumulation of secondary dentine. In many cases, teeth have become the only element to be able *per se* to provide information of an individual or a human population.[2]

Non-metric dental crown traits (NDCT) are phenotypic forms of the enamel that are inherited and controlled in their location, growth and orientation; they result from indirect processes of mineral secretion mediated by proteins during the dental morphogenesis, and they are expressed and regulated by the human genome of each individual. These traits can be described as positive (cusps) or negative structures (pits, furrows and grooves) that have the potential to be present or absent in a specific place (frequency), in a different form or grade (variability), and in one or more members of a population group.[1] There are differences amongst

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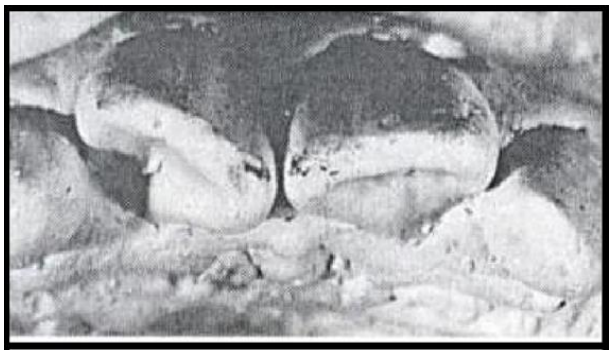


Fig 1: Winging

Fig 2: Shovelling.

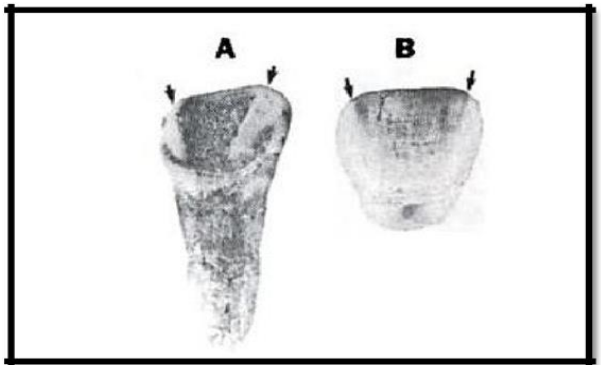


Fig 3: Double shovelling.

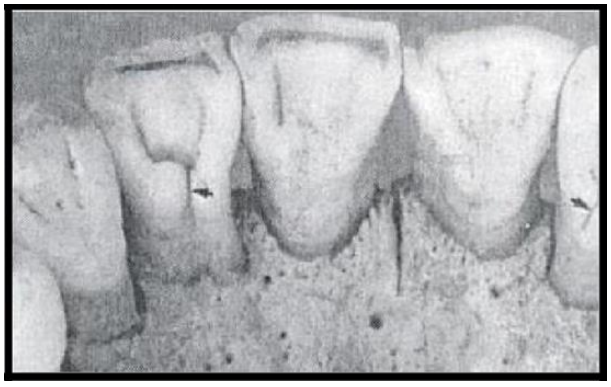
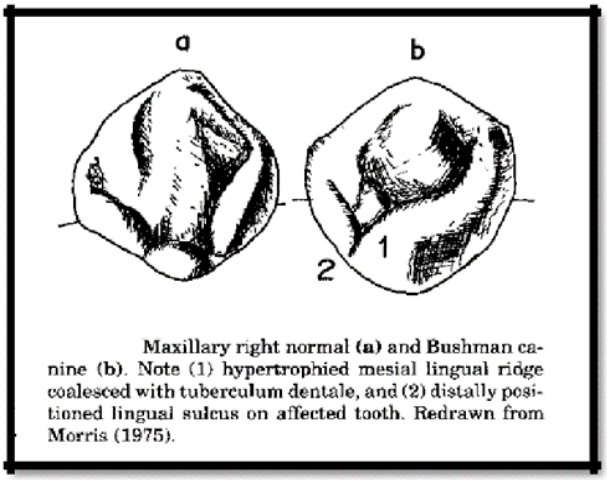
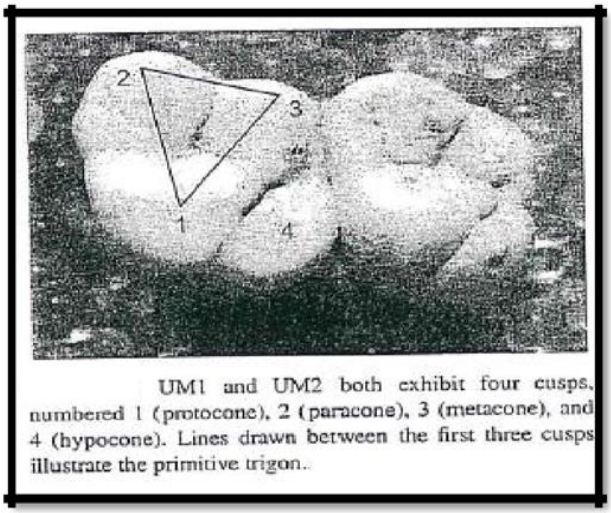


Fig 4: Interruption groove.



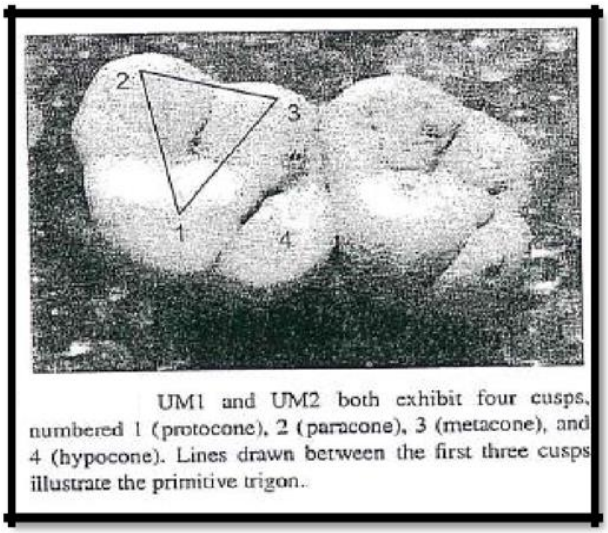
Maxillary right normal **(a)** and Bushman canine **(b)**. Note (1) hypertrophied mesial lingual ridge coalesced with tuberculum dentale, and (2) distally positioned lingual sulcus on affected tooth. Redrawn from Morris (1975).

Fig 5: Bushman Canine.



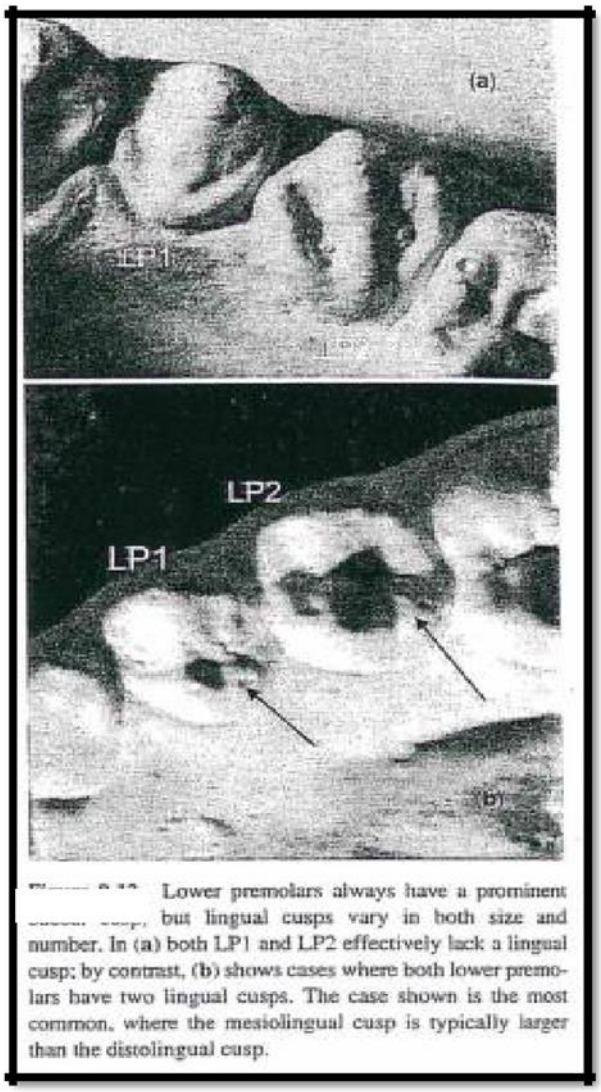
UM1 and UM2 both exhibit four cusps, numbered 1 (protocone), 2 (paracone), 3 (metacone), and 4 (hypocone). Lines drawn between the first three cusps illustrate the primitive trigon.

Fig 6: Hypocone.



UM1 and UM2 both exhibit four cusps, numbered 1 (protocone), 2 (paracone), 3 (metacone), and 4 (hypocone). Lines drawn between the first three cusps illustrate the primitive trigon.

Fig 7: Carabelli's Trait.



Lower premolars always have a prominent [illegible] but lingual cusps vary in both size and number. In (a) both LP1 and LP2 effectively lack a lingual cusp; by contrast, (b) shows cases where both lower premolars have two lingual cusps. The case shown is the most common, where the mesiolingual cusp is typically larger than the distolingual cusp.

Fig 8: Premolar Lingual Cusp Variation.

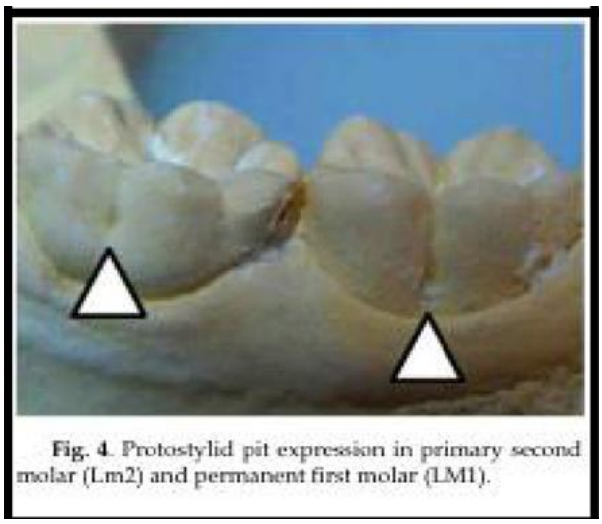
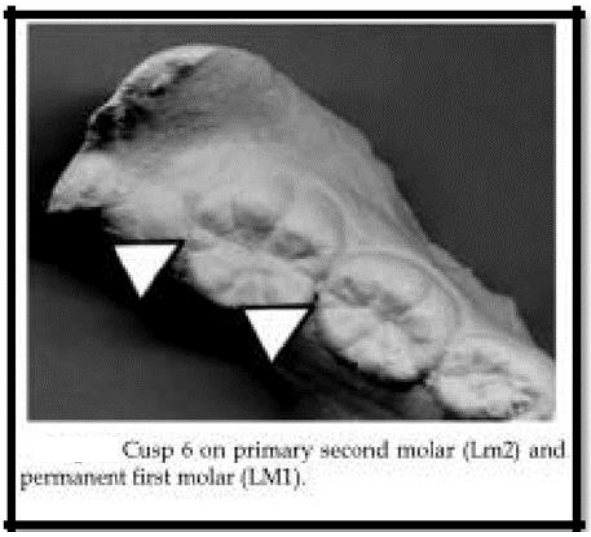


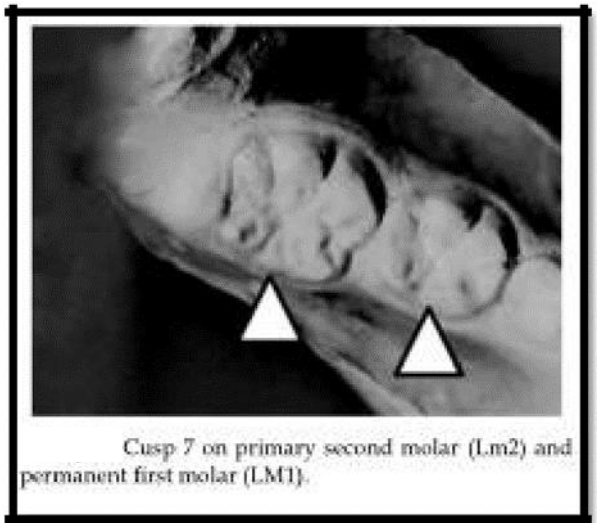
Fig. 4. Protostylid pit expression in primary second molar (Lm2) and permanent first molar (LM1).

Fig 9: Protostylid.



Cusp 6 on primary second molar (Lm2) and permanent first molar (LM1).

Fig 10: Metaconulid.



Cusp 7 on primary second molar (Lm2) and permanent first molar (LM1).

Fig 11: Entoconulid.

various ethnic groups with respect to the above mentioned features. There might also be differences in non metric dental traits such as winging, shovelling, double shovel, interruption grooves, Bushman canine, hypocone, metaconule, carabelli's trait, parastyle, peg shaped lateral, peg Shaped molars, premolar lingual cusp variation, groove pattern, deflecting wrinkle, protostylid, metaconulid, entoconulid. Most studies in literature are anthropologic in nature and reveal variation in the morphology and metrics of the dentition over time and their relation with the processes of adaptation related dietary changes that led to the evolution of the dental system. Only a few studies report frequency and variability with respect to non-metric dental traits in the contemporary Indian

population. Hence the purpose of this study is to evaluate non metric dental traits in the modern ethnically mixed population residing in the city of Vadodara, Gujarat.

Table 1: List of non-metric dental traits evaluated.

S. no.	Trait	Tooth to be evaluated (+/-)	
1.	Winging (Figure 1)	11	21
2.	Shoveling (Figure 2)	12	22
3.	Double-Shoveling (Figure 3)	11	21
4.	Interruption Groove (Figure 4)	12	22
5.	Canine Mesial Ridge (Figure 5)	13	23
6.	Hypocone (Figure 6)	17	27
7.	Metaconule	16	26
8.	Carabelli's Trait (Figure 7)	16	26
9.	Parastyle	18	28
10.	Peg-Shaped Incisors	12	22
11.	Peg-Shaped Molar	18	28
12.	Premolar Lingual Cusp Variation (Figure 8)	35	45
13.	Groove Pattern	37	47
14.	Deflecting Wrinkle	36	46
15.	Protostylid (Figure 9)	36	46
16.	Metaconulid (Figure 10)	36	46
17.	Entoconulid(Figure 11)	36	46

Table 2: Frequency distribution of different non metric dental traits.

TRAIT	*TOOTH*	*FREQUENCY (%)*
Winging	11	14
	21	13
Shoveling	12	22
	22	31
Double-Shoveling	11	0
	21	0
Interruption Groove	12	35
	22	32
Canine Mesial Ridge	13	7
	23	7
Hypocone	17	38
	27	31
Metaconule	16	0
	26	2
Carabelli's Trait	16	53
	26	43
Parastyle	18	0
	28	0
Peg-Shaped Incisors	12	0
	22	1

Peg-Shaped Molar	18	0
	28	0
Premolar Lingual Cusp	35	1= 46, 2=54
	45	1=45, 2=55
Groove Pattern	37	X=78, Y=22
	47	X=80, Y=20
Deflecting Wrinkle	36	2
	46	0
Protostylid	36	0
	46	0
Metaconulid	36	7
	46	4
Entoconulid	36	0
	46	0

Table 3: Variation of different non metric dental traits amongst Gujarati and non- Gujaratis.

TRAIT	*TOOTH*	*GUJARATI*	*NON GUJARATI*	*p value*
Winging	11	12	2	0.877
	21	11	2	0.784
Shoveling	12	19	3	0.92
	22	26	5	0.533
Double-Shoveling	11	0	0	
	21	0	0	
Interruption Groove	12	31	4	0.732
	22	29	3	0.46
Canine Mesial Ridge	13	6	1	0.916
	23	6	1	0.916
Hypocone	17	29	9	0.014
	27	25	6	0.205
Metaconule	16	0	0	
	26	2	0	0.518
Carabelli's Trait	16	46	7	0.948
	26	40	3	0.12
Parastyle	18	0	0	
	28	0	0	
Peg-Shaped Incisors	12	0	0	
	22	1	0	0.698
Peg-Shaped Molar	18	0	0	
	28	0	0	
Premolar Lingual cusp variation	35	1=44, 2=43	1=2, 2=11	0.018
	45	1=41, 2=46	1=4, 2=9	0.524

Groove Pattern	37	X=66, Y=21	X=12, Y=1	0.182
	47	X=68, Y=19	X=12, Y=1	0.234
Deflecting Wrinkle	36	2	0	0.581
	46	0	0	
Protostylid	36	0	0	
	46	0	0	
Metaconulid	36	3	4	0
	46	2	2	0.025
Entoconulid	36	0	0	
	46	0	0	

Table 4: Sexual Dimorphism of different non metric dental traits.

TRAIT	*TOOTH*	*FEMALE*	*MALE*	*p value*
Winging	11	11	3	0.093
	21	10	3	0.138
Shoveling	12	7	15	0.005
	22	18	13	0.993
Double-Shoveling	11	0	0	
	21	0	0	
Interruption Groove	12	22	13	0.47
	22	19	13	0.848
Canine Mesial Ridge	13	7	0	0.02
	23	6	1	0.123
Hypocone	17	24	14	0.375
	27	16	15	0.386
Metaconule	16	0	0	
	26	1	1	0.817
Carabelli's Trait	16	31	22	0.916
	26	23	20	0.427
Parastyle	18	0	0	
	28	0	0	
Peg-Shaped Incisors	12	0	0	
	22	1	0	0.392
Peg-Shaped Molar	18	0	0	
	28	0	0	
Premolar Lingual	35	1=30, 2=28	1=16,2=26	0.177
	45	1=29,2=29	1=16,2=26	0.208

Groove Pattern	37	X=45, Y=13	X=33, Y=9	0.907
	47	X=48,Y=10	X=32, Y=10	0.418
Deflecting Wrinkle	36	1	1	0.817
	46	0	0	
Protostylid	36	0	0	
	46	0	0	
Metaconulid	36	5	2	0.455
	46	3	1	0.482
Entoconulid	36	0	0	
	46	0	0	

MATERIALS AND METHODS

The study was conducted on a total of 100 students of B. D. S and M.D.S course at K. M. Shah Dental College and Hospital, Piparia between 18 to 25 years of age with a caries free dentition having a healthy periodontium. Students having attrited, abraded or eroded teeth were excluded. Also, students having missing or filled teeth were excluded from this study

The participants were informed about the nature of the study and written consent for the same was obtained in language understood by the participant. The study was conducted after approval from the Ethics Committee of Sumandeep Vidyapeeth, Piparia, Vadodara, Gujarat.

Impressions of both arches were made for all participants with irreversible hydrocolloid (alginate) and casts were poured immediately with Dental stone type II which were then observed under a stereomicroscope to evaluate 17 different morphological traits (Table 1)

RESULTS AND DISCUSSION

Severe reduction and the absence of the disto-lingual cusp (hypocone) is a valued trend from the first upper molar to the second upper molar and is associated with a simplification of the dental morphology and reduced size. It was found in a frequency of 38% (17) and 31% (27) (Table II) in the current study. A statistically significant correlation is recorded with respect to the variation of the trait among the Gujarati and non Gujarati population (p=0.014) (17). However, there is absence of sexual dimorphism. Khamis et al[3] recorded the trait with frequency of 78.8%, 74.7%, 76.1% and 80.5% in Malayas, Chinese, Indian and Negritos population respectively with absence of sexual dimorphism, which is in accordance to the current study. Similarly, hypocone showed a high frequency (80-100%) in the Columbian population as well, as reported by Diaz et al[4] . They reported bilateral symmetry and absence of sexual dimorphism.

With respect to the premolar lingual cusp pattern in 37, X groove pattern was observed in 78% of cases and Y pattern was observed in 22% of the cases. Similarly in 47, X groove pattern was observed in 80% of cases and Y pattern was observed in 20% of the cases. No statistically significant variation or sexual dimorphism was observed with respect to this trait. Contrary to the current study, Aguirre L et al[1] reported a frequency of 59% of X groove pattern and 41% of Y pattern among the Columbian population.

Metaconulid was observed in a frequency of 7 % (36) and 4% (46). Statistically significant variation was observed in relation to the trait both in 36 (p=0.000) and 46 (p=0.035). No significant sexual dimorphism was observed. Khamis et al[3] recorded the trait with frequency of 88.0%, 90.4%, 86.5% and 64.1% in Malayas, Chinese, Indian and Negritos population respectively, which is much higher as compared to the current study. However, they also reported absence of sexual dimorphism. Aguirre L et al[1] reported a frequency of 4% in her study population.

Winging involves rotating one or both upper central incisors relative to the midline. Scott and Turner[5]

relate this feature with the absence of space in the dental arch that prevents the proper alignment of the incisors. According to Rodríguez[6], the mesiolingual rotation of both incisors is considered the product of genetic factors while the rotation of a single tooth or both in a disto-lingual direction is caused by crowding. In the present study, frequency of this trait was observed to be 14 (11) and 13% (21) (Table II). A statistically significant sexual dimorphism was recorded with respect to winging (11) (p=0.093)(Table IV) though the variation between Guajarati and non Guajarati population was not significant. This was contrary to the results obtained by Aragon N et al[7] in a population of Amazonian Indians where this feature was observed with high frequency. Diaz et al[4] reported a frequency of 45.6% of the trait in Columbian population. There was no sexual dimorphism reported by him.

Shovel shaped incisors were recorded with a frequency of 22% (12) and 31% (22) respectively in the current study (Table II). There was no significant variation or sexual dimorphism recorded. The shovel shape showed a high frequency in the Columbian population, as reported by Diaz et al[4] along with bilateral symmetry and absence of sexual dimorphism. Turner[5] observed this trait in 98.8% of East Asians and 99.8% of South American Indians. Aragon et al[7] observed high frequencies among indigenous tribes in the Amazon basin. Khamis et al[3] recorded the trait with frequency of 90.7%, 95% 86.5% and 68.6% in Malayas, Chinese, Indian and Negritos population respectively with absence of sexual dimorphism.

Canine mesial ridge or bushman canine was recorded in a frequency of 7% each with respect to both the right and left maxillary canine (Table II). There was no significant variation found amongst the Gujarati and non Gujarati population, though a statistically significant sexual dimorphism (p=0.020) (Table IV) was recorded with respect to this trait in the maxillary right canine. None of the other researches on contemporary populations document the evaluation of this trait. Hence comparisons to other populations could not be made.

Hence, traits such as hypocone, premolar lingual cusp variation and metaconulid showing a statistically significant variation among Gujarati and non Gujarati population may prove to be useful in identification of the ethnic origin of a person. Traits such as winging, shovelling and canine mesial ridge showing significant sexual dimorphism may be used for gender prediction. The limited sample size of the current study emphasizes the need for larger studies with greater sample size to establish the significance of non metric dental traits in personal identification.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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