Original Article

# Deciduous molar sizes and sexual dimorphism: South Indian study

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## ABSTRACT

Odontometrics is the biometric science that studies size of tooth. This tooth size data can be used to compare prehistoric and modern populations; to know the heritabilities and to study the development of dental occlusion. Thus the aim of the present study was to obtain crown dimensions of primary molars in a sample of South Indian children. 100 children between the age groups of 4 to 9 years was randomly selected. Molars presenting anomalies of the crowns, caries or restorations were excluded. Measurements were made on dental plaster models, using digital Vernier calipers. The tooth in the right and left quadrant (antimeric teeth) did not show any statistically significance. Males show larger mean measurement than females. The maximum sexual dimorphism was observed with respect to the buccolingual dimension. Primary first molars had less variability than second molars in the measurements studied. The measurement with less variability was mesiodistal dimension, followed by buccolingual dimension. This is an attempt to obtain average dimensions of primary molars in South Indian children thus the data can be utilized for fabrication of preformed crowns and bands and also to study the patterns of occlusal development. The male children had significantly larger primary molars when compared to female children. The primary first molars exhibited relatively less variability when compared to the second molars.

**Key words:** Buccolingual, Crown Dimensions, Crown Height, Mesiodistal, Odontometrics, Primary Molars, Tooth Dimensions

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## INTRODUCTION

Information concerning tooth size in human population is of importance to clinical dentistry as well as other sciences such as anthropology and tooth anatomy. Teeth are durable, readily accessible for examination, after the eruption, they are unaffected by environment apart from normal wear and pathological processes, due to these reasons tooth measurements have provided valuable data for studies of human phylogeny and ontogeny.[1] Tooth size data has been used by anthropologists to compare prehistoric and modern populations, by geneticists to know the heritabilities and chromosomal influences and by orthodontists and pedodontists to study the normal and abnormal development of dental occlusion. From the anthropological perspective, the determination of tooth size and form is useful for comparing the current population with previous civilizations, given that variations in tooth size can be correlated with different customs, lifestyles and eating habits, as well as variations in the phylogenetic scale of human races.[2]

Tooth size in humans is determined by polygenic genetic factors. The environmental influences include particularly the socio-economic conditions, ethnicity, nutrition, childhood health and maternal aspects such as gestational conditions and systemic factors.[3] Data regarding tooth dimensions are available in abundance in the literature.[2,4-7] However, there is little information available about the primary dentition in Indian population. The aim of the present study is: to obtain standard mesiodistal and buccolingual crown sizes

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of primary molars, know the sexual dimorphism and antimeric (right, left) variability, to predict the variability in crown dimensions and also to compare and correlate the dimensions among various populations.

## MATERIALS AND METHODS

A cross-sectional study was carried out on 3000 children aged ranges from 4 to 9 years during the period of months from December 2011 to February 2013 who visited the department of pediatric and preventive dentistry. Out of 3000 children screened 120 children (60 male and 60 female subjects) were selected based on exclusion and inclusion criteria.

### Inclusion criteria

- Indian children with pure Indian parents and grandparents.
- The tooth should be caries free.
- Completely erupted first and second primary molars.

### Exclusion criteria

- Anomalies of tooth size and shape.
- Infra-occluded molars/submerged teeth.
- Pathologic occlusal erosion or crown fractures.
- Molars treated with preformed crowns/teeth which are part of fixed orthodontic appliances/fixed space maintainers.

After taking institutional ethical committee clearance, the parents/guardians of the children were thoroughly explained regarding the study procedure. All the selected samples were initially subjected to oral prophylaxis, impressions were made with Alginate and casts were pored immediately with dental stone. The maxillary and mandibular models thus obtained were inspected and those with voids, cracks, fractures or irregularities were discarded. Only 100 sets of high quality models (53 male and 47 female subjects) were selected and study models were prepared. The models thus obtained were finished and numbered for ease of identification [Figure 1].

Electronic digital caliper (BAKER SDN 10, India)* calibrated to the nearest 0.01 mm was used to measure the mesiodistal and bucco-lingual dimensions of primary molars (both D and E) following the evaluation criteria put forth by Barbería *et al.*[2] The measurements thus obtained were analyzed statistically and the significant value was determined if $P < 0.05$.

- Mesiodistal dimension: The distance between the mesial and distal points of contact, measured with the caliper placed parallel to the occlusal surface [Figure 2].
- Buccolingual dimension: The maximum width between the buccal and lingual surfaces measured with a digital caliper placed perpendicular to the mesiodistal size [Figure 3].

All the measurements were noted by a single examiner and the values thus obtained were tabulated and subjected to statistical analysis using the statistical package for social sciences SPSS version 17.0 (IBM, Chicago). To check the intra and inter examiner variability and to determine the reliability of the measurements, 20 study models were randomly picked and measured by the initial examiner and by a separate investigator who was unaware of the prior measurements. No significant variation in

**Figure 1:** Study models


**Figure 2:** Recording the mesio-distal measurement on the study model using digital Vernier calipers


**Figure 3:** Recording the bucco-lingual measurement on the study model using digital Vernier calipers

the measurements was obtained. As the correlation co-efficient was very high, ($r$ = 0.95) all the subsequent measurements were taken only once.

## RESULTS

The values thus obtained were statistically evaluated for mean molar sizes, antimeric variability along with variations in individual tooth measurements and Sexual dimorphism. The antimeric molars were compared utilizing unpaired $t$-test and this did not yield any statistically significant difference in any of the studied dimensions [Table 1 and Figure 4].

Table 2 and Figure 5 reflects the mean molar sizes and variability in individual tooth measurements standard mean error and standard deviation of primary molars in both dimensions. Based on the standard deviation obtained for each molar and each measurement and for the maxilla and the mandible, it was noticed that, in the total sample, primary first molars had less variability than second molars in both the measurements studied. Upper first molar has less variability than lower first molars, in regard to mesiodistal dimension, but more variable in buccolingual dimension. The measurement with least variability was mesiodistal dimension.

**Table 1: Comparison of the mean values of antimeric molar sizes**

| Tooth no. | Mesiodistal | | P value | Buccolingual | | P value |
|---|---|---|---|---|---|---|
| | Mean | SD | | Mean | SD | |
| 54 | 6.35 | 0.48 | 0.510 | 8.81 | 0.43 | 0.601 |
| 64 | 6.33 | 0.5 | | 8.73 | 0.61 | |
| 55 | 8.70 | 0.64 | 0.571 | 9.77 | 0.49 | 0.099 |
| 65 | 8.63 | 0.63 | | 9.76 | 0.49 | |
| 74 | 7.51 | 0.49 | 0.435 | 7.69 | 0.63 | 0.304 |
| 84 | 7.47 | 0.52 | | 7.62 | 0.63 | |
| 75 | 9.44 | 0.61 | 0.430 | 9.03 | 0.51 | 0.419 |
| 85 | 9.41 | 0.61 | | 8.96 | 0.55 | |

Statistically significant if $P < 0.05$, SD: Standard deviation

Sexual dimorphism [Table 3 and Figure 6] was studied by comparing mean values of each measurement utilizing the

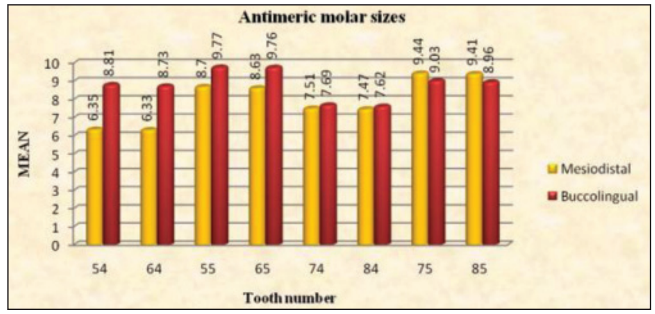


**Figure 4:** Comparison of the mean values of antimeric molar sizes

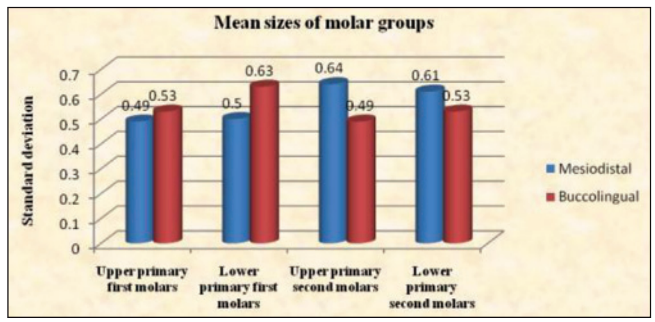


**Figure 5:** Mean sizes of molar groups

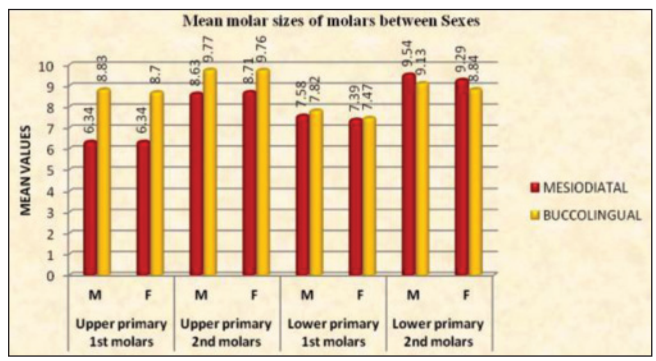


**Figure 6:** Comparison of mean molar sizes between sexes

**Table 2: Mean sizes of molar groups**

| Molars compared | Sex | N | Mesiodiatal | | | | Buccolingual | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | X | SEM | SD | P value | X | SEM | SD | P value |
| Upper primary 1st molars | Male | 106 | 6.34 | 0.046 | 0.47 | 0.956 | 8.83 | 0.056 | 0.57 | 0.014* |
| | Female | 94 | 6.34 | 0.052 | 0.51 | | 8.70 | 0.049 | 0.47 | |
| | Total | 200 | 6.34 | 0.035 | 0.49 | | 8.77 | 0.038 | 0.53 | |
| Lower primary 1st molars | Male | 106 | 7.58 | 0.046 | 0.47 | 0.784 | 7.82 | 0.057 | 0.58 | 0.667 |
| | Female | 94 | 7.39 | 0.054 | 0.52 | | 7.47 | 0.066 | 0.64 | |
| | Total | 200 | 7.49 | 0.036 | 0.50 | | 7.66 | 0.045 | 0.63 | |
| Upper primary 2nd molars | Male | 106 | 8.63 | 0.069 | 0.71 | 0.012* | 9.77 | 0.048 | 0.49 | 0.000* |
| | Female | 94 | 8.71 | 0.057 | 0.55 | | 9.76 | 0.050 | 0.49 | |
| | Total | 200 | 8.66 | 0.045 | 0.64 | | 9.76 | 0.035 | 0.49 | |
| Lower primary 2nd molars | Male | 106 | 9.54 | 0.054 | 0.55 | 0.024* | 9.13 | 0.055 | 0.56 | 0.000* |
| | Female | 94 | 9.29 | 0.067 | 0.65 | | 8.84 | 0.045 | 0.43 | |
| | Total | 200 | 9.43 | 0.043 | 0.61 | | 8.99 | 0.037 | 0.53 | |

*Statistically significant if $P < 0.05$, SD: Standard deviation, SEM: Standard error of mean

**Table 3: Comparison of mean molar sizes between sexes**

| Molars compared | Sex | Mesiodiatal | | | Buccolingual | | |
|---|---|---|---|---|---|---|---|
| | | *N* | *X* | *P* | *N* | *X* | *P* |
| Upper primary 1st molars | Male | 106 | 6.34 | 0.956 | 106 | 8.83 | 0.014* |
| | Female | 94 | 6.34 | | 94 | 8.7 | |
| Upper primary 2nd molars | Male | 106 | 8.63 | 0.784 | 106 | 9.77 | 0.667 |
| | Female | 94 | 8.71 | | 94 | 9.76 | |
| Lower primary 1st molars | Male | 106 | 7.58 | 0.012* | 106 | 7.82 | 0.000* |
| | Female | 94 | 7.39 | | 94 | 7.47 | |
| Lower primary 2nd molars | Male | 106 | 9.54 | 0.024* | 106 | 9.13 | 0.000* |
| | Female | 94 | 9.29 | | 94 | 8.84 | |

*Statistically significant if $P < 0.05$

Mann Whitney U test. Male children had larger primary molar sizes compared to female children. This difference is more in lower primary molars (*P*-values 0.012, 0.000, 0.024 and 0.000) than upper primary molars. Upper primary 2nd molars do not show any significant sexual dimorphism (0.784, 0.667). Lower primary 1st and 2nd molars showed statistically significant dimorphism; grossly males have larger dimensions compared to females.

## DISCUSSION

Tooth size measurements provide valuable data for anthropology, forensic and clinical purposes as this data provides useful information for providing extra coronal restorations on the teeth and for understanding the occlusion of deciduous dentition in the pediatric population. Studies on tooth size measurements are abundant in the literature but relatively low in the primary dentition. But with respect to Indian population very sparse information is available. Thus, this present study was carried out to measure the average mesiodistal and buccolingual dimensions of primary molars in a sample of healthy South Indian children.

Tooth measurements can be determined by using direct (mouth) and indirect (plaster models) methods. Though the majority of authors used plaster models, there were few studies in which measurements were obtained directly from the mouth of the individual.[4-6,8] Anderson compared both these techniques in his odontometric study and stated that there was no statistically significant difference between the two methods.[7] Hunter and Priest stated that measuring maxillary molars directly in the mouth poses certain difficulties due to anatomical factors and they proved that mesiodistal measurements if obtained directly from the mouth yielded lesser values when compared to the indirect method. They also stated that the measurements performed on soaped cast models are not significantly larger than those performed on non-soaped models.[9] Hence indirect and non-soaped casts were considered for this odontometric study.

Different methods have been used to measure tooth dimensions, many researchers employed sliding caliper with a Vernier scale to obtain the metrical data of the teeth, due to its accuracy over other methods.[9] The use of digital Vernier calipers can virtually eliminate measurement transfer and calculation errors when compared with divider and calculator. Although, some measurement errors may associate with the positioning of the calipers on the mesial and distal surfaces of the teeth, this method is certainly more reliable than manual measurements. In the present study, the tooth measurements were done by contact method indirectly on the casts using digital Vernier calipers (BAKER SDN 10, India)* with error of 0.01 mm since it is easy, fast and accurate and also the errors were minimal with this method.[10] The measurements were analyzed and the significance was determined if $P < 0.05$.

To facilitate comparison of the present study results with those of earlier published clinical studies, the average measurements of all the studies were compiled [Table 4]. The most striking feature is that the maxillary 2nd primary molar yielded greater dimensions in terms of both mesiodistal length (8.66 mm) and buccolingual width (9.76 mm) compared to studies done on Australia aborigines (8.08 and 7.8), Spanish white children (7.82 and 6.88), UK population (7.61 and 6.99), Iceland population (7.89 and 7.32), USA white children (7.61 and 8.21).[1-3,6,10-22] Whereas both these measurements in the present study were smaller when compared with the previously mentioned studies with respect to the other molars in the study, i.e., maxillary 1st primary molar (6.34, 8.76), mandibular 1st (7.48, 7.64) and 2nd primary molar (9.41, 8.98) except in Moyers *et al*. study done on USA white children.[19] In that particular study mandibular 2nd primary molar mesiodistal dimension was smaller in females (8.88 and 9.29) compared to the present study. Interestingly a study done on Brazil children[23] all the primary molars had larger mesiodistal (8.5 and 7.97) measurement while all buccolingual (8.5 and 8.78) measurements were smaller compared to the present study.

As it was already a proven fact that mesiodistal dimension of mandibular teeth is larger than the maxillary teeth and buccolingual dimension of maxillary teeth is greater

**Table 4: Values for mesiodistal and buccolingual sizes of primary molars obtained by different authors**

| Author | Location | Sex | Mesidistal size | | | | Buccolingual/patal size | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mb1 | Mb2 | Mx1 | Mx2 | Mb1 | Mb2 | Mx1 | Mx2 |
| Moorrees *et al.* 1957 | USA white children | Male | 9.08±0.46 | 9.83±0.52 | 7.12±0.38 | 7.80±0.42 | No | | | |
| | | Female | 8.84±0.55 | 9.64±0.49 | 6.95±0.36 | 7.65±0.35 | | | | |
| Moyers *et al.* 1976 | USA white children | Mala | 8.84±0.53 | 9.90±0.52 | 6.74±0.49 | 7.82±0.47 | 8.74±0.47 | 9.73±0.48 | 6.61±0.49 | 7.71±0.46 |
| | | Female | 9.51±0.48 | 8.88±0.40 | 8.82±0.50 | 7.41±0.49 | 9.33±0.41 | 8.71±0.41 | 8.59±0.52 | 8.71±0.41 |
| Margetts and Brown 1978 | Australia aborigines | Male | 9.65±0.571 | 0.89±0.61 | 7.55±0.52 | 8.25±0.58 | 9.42±0.46 | 10.64±0.49 | 7.28±0.44 | 8.12±0.45 |
| | | Female | 10.65±0.55 | 9.87±0.49 | 9.07±0.59 | 7.92±0.51 | 10.27±0.44 | 9.57±0.49 | 8.77±0.47 | 7.49±0.51 |
| Lysell and Myrberg 1982 | Sweden | Male | 8.60±0.47 | 9.50±0.51 | 6.94±0.43 | 7.64±0.49 | No | | | |
| | | Female | 8.38±0.43 | 9.31±0.49 | 6.75±0.41 | 7.41±0.50 | | | | |
| Steigman *et al.* 1982 | Israel | Male | 8.75±0.04 | 9.67±0.05 | 6.99±0.04 | 7.59±0.05 | No | | | |
| | | Female | 8.59±0.04 | 9.50±0.04 | 6.77±0.04 | 7.37±0.05 | | | | |
| Axelsson and Kirveskari 1984 | Iceland | Male | 9.00±0.45 | 10.11±0.44 | 7.17±0.48 | 7.98±0.45 | 10.10±0.44 | 9.09±0.37 | 8.87±0.46 | 7.35±0.40 |
| | | Female | 8.97±0.45 | 9.95±0.48 | 7.04±0.40 | 7.81±0.45 | 9.88±0.41 | 9.02±0.38 | 8.69±0.40 | 7.29±0.38 |
| Vaughan and Harris 1992 | USA black children | Male | 9.07±0.78 | 10.53±0.58 | 7.70±0.60 | 8.41±0.58 | 10.16±0.64 | 9.15±0.61 | 9.13±0.58 | 7.98±0.50 |
| | | Female | 9.08±0.78 | 10.25±0.45 | 7.60±0.56 | 8.18±0.37 | 10.01±0.46 | 9.03±0.46 | 9.03±0.42 | 7.84±0.48 |
| Fearne and Brook 1993 | UK | Male+female | 8.77±0.52 | 9.55±0.59 | 6.25±0.44 | 7.61±0.56 | 9.80±0.57 | 8.86±0.48 | 8.35±0.57 | 6.69±0.47 |
| Yuen *et al.* 1997 | China | Male | 9.26±0.48 | 10.30±0.47 | 7.41±0.39 | 8.18±0.46 | No | | | |
| | | Female | 9.16±0.44 | 10.15±0.40 | 7.26±0.38 | 8.10±0.47 | | | | |
| Harila *et al.* 2003 | USA white children (right) | Male | 8.87±0.48 | 9.90±0.49 | 7.09±0.43 | 7.75±0.44 | 9.65±0.52 | 8.89±0.49 | – | – |
| | | Female | 8.68±0.52 | 9.97±0.48 | 6.87±0.48 | 7.62±0.42 | 9.42±0.48 | 8.71±0.50 | – | – |
| | USA black children (right) | Male | 9.26±0.55 | 10.38±0.46 | 7.58±0.47 | 8.24±0.51 | 9.96±0.49 | 9.14±0.51 | – | – |
| | | Female | 9.00±0.51 | 10.03±0.48 | 7.40±0.52 | 8.02±0.45 | 9.68±0.47 | 8.85±0.48 | – | – |
| Warren *et al.* 2003 | USA white children current sample | Male | 8.8±0.5 | 10.1±0.5 | 7.2±0.4 | 8.0±0.5 | No | | | |
| | | Female | 8.6±0.4 | 9.9±0.4 | 7.0±0.4 | 7.8±0.4 | | | | |
| | USA white children previous sample | Male | 8.7±0.4 | 9.9±0.4 | 7.1±0.4 | 7.9±0.4 | No | | | |
| | | Female | 8.6±0.4 | 9.9±0.4 | 6.9±0.4 | 7.6±0.4 | | | | |
| Kondo and Townsend 2004 | Australia aborigines | Male | – | 11.22±0.65 | – | 8.54±0.55 | – | 9.92±0.54 | – | 7.97±0.58 |
| | | Female | – | 10.89±0.39 | – | 8.36±0.43 | – | 9.71±0.40 | – | 7.69±0.43 |
| Anderson 2005 | USA African-Americans | Male | 9.21±0.54 | 10.32±0.37 | 7.51±0.50 | 8.19±0.50 | No | | | |
| | | Female | 8.87±0.55 | 9.94±0.57 | 7.21±0.53 | 7.91±0.54 | | | | |
| Barbería *et al.* 2009 | Spain white children | Male | 9.25±0.53 | 9.96±0.54 | 7.40±0.55 | 7.94±0.52 | 9.47±0.80 | 8.89±0.60 | 7.96±0.82 | 6.90±0.77 |
| | | Female | 9.12±0.48 | 9.70±0.46 | 7.14±0.59 | 7.71±0.47 | 9.33±0.74 | 8.72±0.58 | 7.87±0.77 | 6.86±0.59 |
| Bravo *et al.* 2010 | Spain white children | Male | – | 9.83±0.50 | - | 8.93±0.45 | No | | | |
| | | Female | – | 9.57±0.38 | - | 8.70±0.41 | | | | |
| Anfe *et al.* 2012 | Brazil population | Male+female | 8.09±0.50 | 10.01±0.44 | 6.99±0.45 | 8.92±0.57 | 7.05±0.43 | 8.67±0.45 | 8.66±0.58 | 9.62±0.48 |
| Authors | South Indian children | Male | 7.58±0.47 | 9.54±0.55 | 6.34±0.47 | 8.63±0.71 | 7.82±0.58 | 9.13±0.56 | 8.83±0.57 | 9.77±0.49 |
| | | Female | 7.39±0.52 | 9.29±0.66 | 6.34±0.51 | 8.71±0.55 | 7.47±0.64 | 8.84±0.43 | 8.70±0.47 | 9.76±0.49 |

Mb1: Mandibular 1st molar, Mb2: Mandibular 2nd molar, Mx1: Maxillary 1st molar, Mx2: Maxillary 2nd molar

than mandibular counter parts even this study has reconfirmed that in accordance with previously published studies.[2,3,5,14,18,19,22,24,25] [Table 2].

When the tooth measurements were viewed in terms of sexual dimorphism [Table 3], boys had large molar sizes when compared with girls. Mandibular primary molars showed significant dimorphism than maxillary molars which is in contrast with the study on Iceland population,[18] where significant dimorphism was reported with maxillary primary molars. The greater sexual dimorphism was observed in buccolingual dimension which is in accordance with the study done by Margetts and Brown[3] in Australian aborigines, in contrast Barbería *et al.*,[2] in Spanish white children, reported absence sexual dimorphism in buccolingual dimension. According to the study of Yuen *et al.*,[6] sexual dimorphism is totally absent in Chinese population.

Though Tejero *et al.*,[26] have reported a significant difference in antimeric (right and left) teeth comparison with reference to maxillary second primary molars, the present study did not yielded any statistically significant difference in terms of antimeric measurements. This is in accordance with the studies done on USA white children,[4] China population,[6] Spanish white children,[2,11] Australia Aborigines[3] and USA African — Americans.[7]

When the individual tooth variability was studied maxillary and mandibular 1st primary molars were more stable when compared to 2nd primary molars, which is accordance with the studies done on Spanish white children,[2] Australia Aborigines,[22] Brazil population[23] and is in contrast with a study done on Australian Aborigines.[3] Among 1st primary molars, maxillary 1st primary molars were more stable compared to mandibular counter parts this is in contrast with a study done on Brazil population by Anfe *et al*.[23] where they reported more stability with mandibular 1st primary molars. The mesiodistal dimension of primary maxillary molar is more stable, but buccolingual dimension exhibited variability this is in contrast with the study results of Kondo and Townsend on Australian Aborigines.[22] The variability is approximately same in upper and lower primary second molars in all the dimensions which is in contrast with the previous study done on Spanish white children by Barbería *et al*.[2] who reported lower second molars were less variable than upper second molars in regard to mesiodistal dimension. Grossly if one looks at the results of the present study the prominent feature is that the maxillary 2nd primary molar yielded greater values in terms of both mesiodistal and buccolingual measurements than almost all reference articles sited in the study [Table 4] whereas maxillary1st, mandibular 1st and 2nd molars exhibited some amount of variability.

## CONCLUSION

Based on the results obtained the male children had significantly larger primary molars when compared to female children and the primary first molars exhibited relatively less variability when compared to the second molars. Information about tooth size measurements is important for anthropological and forensic significance and for clinical practice. As an anthropological and forensic significance odontometric variations coupled with morphological variations can contribute greatly to the understanding of evolutionary trends in man, along with hereditary factors for crown dimensions between the populations' adoptive response to diet and general health of individual during ontogeny must be considered. These measurements provide valuable sources to the manufacturers of standard sized preformed crowns and bands and for clinicians to select them and to understand the developing occlusion and malocclusion. Thus, this provides a basic record of deciduous molar sizes in a group of South Indian population. However, further studies with larger sample size, with systematically distributed sampling technique which including measurements for all the teeth are required to test and to generalize these results to the entire population.

## REFERENCES


1. Moorrees CF, Reed RB. Biometrics of crowding and spacing of the teeth in the mandible. Am J Phys Anthropol 1954;12:77-88.
2. Barbería E, Suárez MC, Villalón G, Maroto M, García-Godoy F. Standards for mesiodistal and buccolingual crown size and height of primary molars in a sample of Spanish children. Eur J Paediatr Dent 2009;10:169-75.
3. Margetts B, Brown T. Crown diameters of the deciduous teeth in Australian aboriginals. Am J Phys Anthropol 1978;48:493-502.
4. Jensen E, Kai-Jen Yen P, Moorrees CF, Thomsen SO. Mesiodistal crown diameters of the deciduous and permanent teeth in individuals. J Dent Res 1957;36:39-47.
5. Lysell L, Myrberg N. Mesiodistal tooth size in the deciduous and permanent dentitions. Eur J Orthod 1982;4:113-22.
6. Yuen KK, So LL, Tang EL. Mesiodistal crown diameters of the primary and permanent teeth in southern Chinese – A longitudinal study. Eur J Orthod 1997;19:721-31.
7. Anderson AA. Dentition and occlusion development in African American children: Mesiodistal crown diameters and tooth-size ratios of primary teeth. Pediatr Dent 2005;27:121-8.
8. Axelsson G, Kirveskari P. Crown size of permanent teeth in Icelanders. Acta Odontol Scand 1983;41:181-6.
9. Hunter WS, Priest WR. Errors and discrepancies in measurement of tooth size. J Dent Res 1960;39:405-14.
10. Sridhar K, Arun AV, Swamy K, Kumar PK, Kumar CH, Verma KV. Morphometrics of permanent dentition in Chennai population. J Indian Orthod Soc 2011;45:110-8.
11. Bravo N, Facal M, Maroto M, Barbería E. Relationship between mesiodistal crown diameters of permanent first molars and deciduous second molars. Eur J Paediatr Dent 2010;11:115-21.
12. Moorrees CF, Reed RB. Correlations among crown diameters of human teeth. Arch Oral Biol 1964;9:685-97.
13. Black TK 3rd. Sexual dimorphism in the tooth-crown diameters of the deciduous teeth. Am J Phys Anthropol 1978;48:77-82.
14. Garn SM, Osborne RH, Alvesalo L, Horowitz SL. Maternal and gestational influences on deciduous and permanent tooth size. J Dent Res 1980;59:142-3.
15. Townsend GC. Fluctuating asymmetry in the deciduous dentition of Australian Aboriginals. J Dent Res 1981;60:1849-57.
16. Liversidge HM, Molleson TI. Deciduous tooth size and morphogenetic fields in children from Christ Church, Spitalfields. Arch Oral Biol 1999;44:7-13.
17. Kitagawa Y, Manabe Y, Oyamada J, Rokutanda A. Japanese deciduous tooth size: Past and present. Anthropol Sci 2002;110:335-47.
18. Axelsson G, Kirveskari P. Crown size of deciduous teeth in Icelanders. Acta Odontol Scand 1984;42:339-43.
19. Moyers RE, Van der Linden FP, Riolo ML, McNamara JA. Standards of Human Occlusal Development. Monograph No. 5. Craniofacial Growth

Series. Ann Arbor: Center for Human Growth and Development, University of Michigan; 1976. p. 43-8. Available from: http://www.openlibrary.org/books/OL14740707M/Standards_of_human_occlusal_development. [Last cited on 2013 Sep 06].
20. Sawyer DR, Allison MJ, Pezzia A, Mosadomi A. Crown dimensions of deciduous teeth from pre-Columbian Peru. Am J Phys Anthropol 1982;59:373-6.
21. Fearne JM, Brook AH. Small primary tooth-crown size in low birthweight children. Early Hum Dev 1993;33:81-90.
22. Kondo S, Townsend GC. Sexual dimorphism in crown units of mandibular deciduous and permanent molars in Australian Aborigines. Homo 2004;55:53-64.
23. Anfe TE, Arakaki Y, Nakamura DM, Vieira GF. Mesiodistal and buccolingual crown size if deciduous teeth from a tooth bank in Brazil. Braz Dent Sci 2012;15:74-8.
24. Warren JJ, Bishara SE, Yonezu T. Tooth size-arch length relationships in the deciduous dentition: A comparison between contemporary and historical samples. Am J Orthod Dentofacial Orthop 2003;123:614-9.
25. Mirzakouchaki B, Shahrbaf S, Talebiyan R. Determining tooth size ratio in an Iranian-Azari population. J Contemp Dent Pract 2007;8:86-93.
26. Tejero A, Plasencia E, Laniza A. Biometric study the primary dentition. Rev Esp Chur 1991;21:167-79.

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