

# Ethnicity and Gender Determination by Means of Intercanine and Intermolar Width in Uttarakhand Population.

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## ABSTRACT

**Background:** Teeth are an excellent material in living and non-living populations for anthropological and forensic investigations as they are the hardest and chemically most stable tissues of the body. The dentition used in gender determination has been explored, as they exhibit the least turnover of natural structure and are readily accessible for examination as they are resistant to various insults. Our aim was to determine and evaluate the usefulness of Intercanine, Intermolar arch width for gender determination and for ethnicity difference of the people living in Uttarakhand and to validate its use as a forensic tool. **Methods:** 100 subjects were selected and impressions were made for maxillary arch with alginate. Study models were made and analysed with digital Vernier calliper. **Results:** The mean Inter canine width and the mean intermolar width were higher in males than females and the differences were highly significant statistically [ $P < 0.008$ ]. On comparing between Punjabi and native population of Uttarakhand, the ICD & IMD values were higher in Punjabi population [ $P < 0.001$ ]. **Conclusion:** Therefore, we can conclude that the Intercanine and intermolar widths are useful in determining the gender/ ethnicity of the population.

**Keywords:** Anthropological, forensic, dentition, intercanine, intermolar, ethnicity, vernier caliper, statistically.

## INTRODUCTION

Teeth are an excellent material in living & non-living populations for anthropological, genetic, odontological and forensic investigations as they are the hardest and chemically most stable tissues of the body. They exhibit the least turnover of natural structure and are readily accessible for examination.<sup>[1]</sup> Recognition of gender is very important for medicolegal as well as archeological aspects. It can be done by various ways. It is also necessary in mass disasters like Tsunami, earthquakes, cyclones, floodsetc. Odontometric characteristics play a major role in sex determination in such situations, especially where small skeletal fragments like jaws are available, particularly with teeth in it.<sup>[2,3]</sup> Sexual dimorphism is a condition where the two sexes of the same species exhibit different characteristics beyond the differences in their sexual organs. Differences may include size,

stature, colour, markings and morphology of the individuals.<sup>[4]</sup>

It was found that mandibular canines exhibit the greatest sexual dimorphism amongst all teeth.<sup>[5]</sup> Recently first molars have been used for gender determination. This is due to the fact that these are first permanent teeth to erupt in both the arches, and are very rarely impacted especially in cases when canines are impacted or missing.<sup>[6,7]</sup>

Hence, the present study has been aimed to find out the mean values of intercanine width and intermolar width in maxilla for both males and females in both Uttarakhand population and Punjabi population residing in Uttarakhand. To compare the intercanine width and intermolar width of both set of populations. Thus determining whether ICD and IMD can be used as a tool for sexual dimorphism as well as ethnicity.

### Aims and objectives:

1. To determine the mean values of Inter Canine & Inter Molar Width of maxilla in the native population of Uttarakhand.
2. To find the mean values of Inter Canine & Inter Molar Width of maxilla in Punjabi population residing in Uttarakhand State.

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3. Comparison of Inter Canine Distance & Inter Molar Distance of native population with Punjabi population residing in Uttarakhand State.
4. Can Inter Canine arch width & Inter Molar arch width be used to determine Sexual Dimorphism.

### **MATERIALS & METHODS**

100 subjects, 50 females and 50 males in the age group of 18- 50 years were selected for this study. The study was conducted in a private dental set up.

#### **Inclusion criteria**

1. Ages between 18- 50 years.
2. No spacing between teeth.
3. No inclination, missing , caries in teeth .
4. Normal Canine and molar relationships

#### **Exclusion Criteria**

1. Patients with abnormal overjet and overbite.
2. Patients with impacted canines.
3. Patients with broken or attrited teeth.
4. Patients with abnormal habits (bruxism)

Once the patients were selected for the study they were explained orally regarding the study and after their voluntary approval, a written consent was taken from all of them.

Maxillary impressions were taken following aseptic conditions, with alginate impression material. The study cast models of impressions were prepared with dental stone and were used for odontometric analysis. All measurements were taken using a digital vernier calliper having a resolution of 0.1 mm/0.01'' and accuracy of +/- 0.1 mm/0.01''.

Intercanine width: The intercanine distance was measured from the cusp tip of canine of one side of arch to the cusp tip of canine on another side of same arch. The data collected was tabulated and statistically analysed.

Inter molar width: The intermolar distance was measured from the central fossa of first molar of one side of arch to the central fossa of first molar on another side of same arch. The data collected was tabulated and statistically analysed.

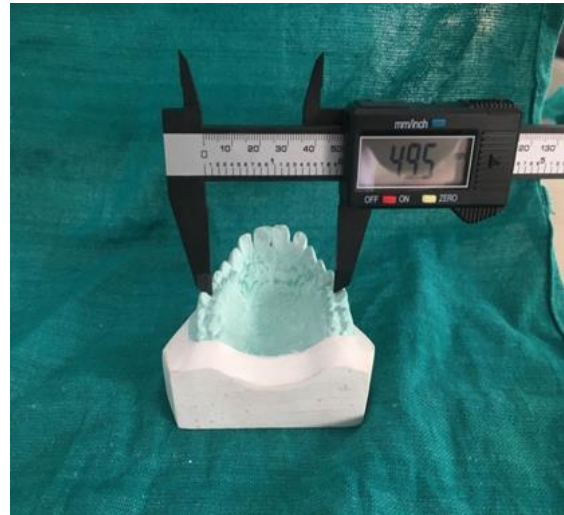
The means for both intercanine and intermolar width for males and females were calculated. Student 't' test was used for comparison.



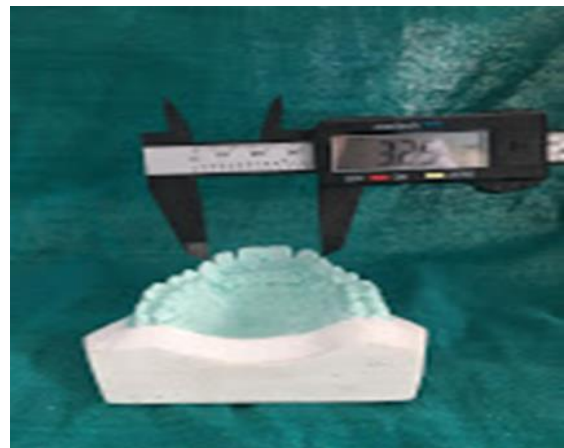
**Figure 1: Materials used for Impressions.**



**Figure 2: Digital Vernier Calliper.**



**Figure 3: Measuring the intermolar distance.**



**Figure 4: Measuring the intercanine distance.**

1. Comparison was done between the ICD and the IMD values of males and females of Uttarakhand population.
2. Comparison was also done between the ICD and the IMD values of native population and Punjabi population residing in Uttarakhand.

### **RESULTS**

1. The mean intercanine distance was found to be 34.948 mm in males and 32.914 mm in females .The difference was found to be highly significant with' p' value 0.008.

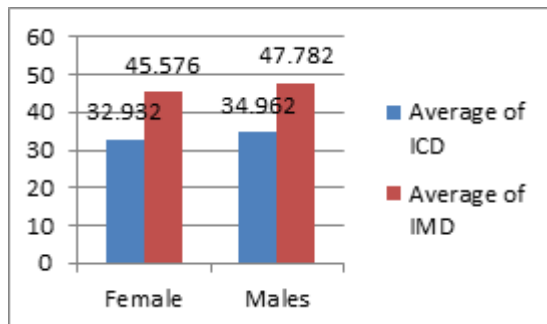
2. The mean intermolar distance was found to be 47.728 mm in males as compared to 45.574 mm in females. The difference was found to be again highly significant, with 'p' value 0.007 [Table 1 and stat 1]

**Table 1: T – TEST**

	gender	N	Mean	Std. Deviation	Std. Error Mean
ICD	MALES	50	34.9480	4.48973	.63494
	FEMALES	50	32.9140	2.86734	.40550
IMD	MALES	50	47.7820	4.56436	.64550
	FEMALES	50	45.5740	3.43932	.48639

**Stat 1:**

	Levene's Test for Equality of Variances		t-test for Equality of Means							
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
								Lower	Upper	
ICD	Equal variances assumed	13.608	0	2.7	98	.008**	2.034	0.75338	0.53894	3.52906
	Equal variances not assumed			2.7	83.27	0.008	2.034	0.75338	0.53562	3.53238
IMD	Equal variances assumed	2.942	0.089	2.732	98	.007**	2.208	0.80824	0.60408	3.81192
	Equal variances not assumed			2.732	91.078	0.008	2.208	0.80824	0.60256	3.81344



3. The mean intercanine distance for Punjabi population residing in Uttarakhand is 36.248 +/- 3.2616 mm.

The mean intercanine distance for the native population of Uttarakhand is 31.614 +/- 2.9826 mm.

The difference was statistically highly significant. 'p' value < 0.001 .

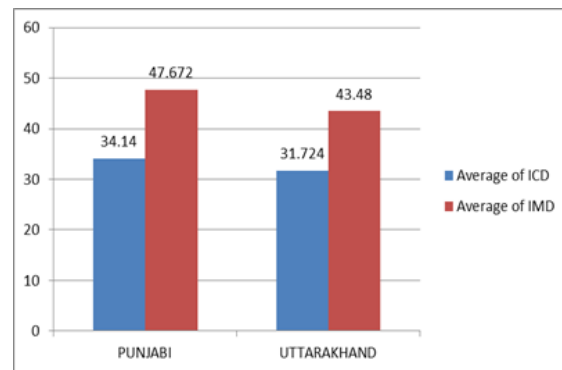
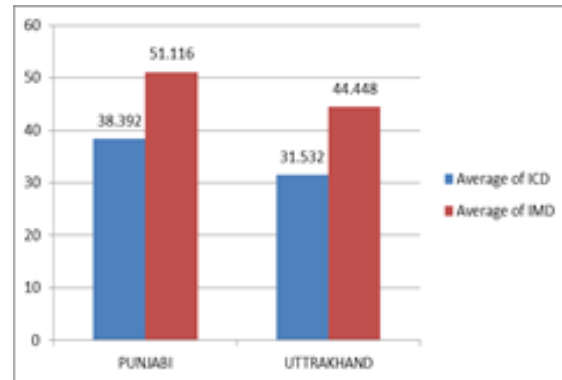
4. The mean intermolar distance of the Punjabi population living in Uttarakhand is 49.394 +/- 2.72mm and ,the mean IMD of native population is 43.962 +/- 3.5624 mm. The difference being highly significant . 'p' value < 0.001 [Table 2 stat 2]

**Table 2:**

	ETHNICITY	N	Mean	Std. Deviation	Std. Error Mean
ICD	PUNJABI	50	36.2480	3.26160	.46126
	UTTRAKHAND	50	31.6140	2.98260	.42180
IMD	PUNJABI	50	49.3940	2.72002	.38467
	UTTRAKHAND	50	43.9620	3.56324	.50392

**Stat 2:**

	Independent Samples Test									
	Levene's Test for Equality of Variances		t-test for Equality of Means							
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
								Lower	Upper	
ICD	Equal variances assumed	.109	.742	7.414	98	<.001**	4.63400	.62504	3.38950	5.87438
	Equal variances not assumed			7.414	97.227	.000	4.63400	.62504	3.38950	5.87450
IMD	Equal variances assumed	11.633	.001	8.568	98	<.001**	5.43200	.63396	4.17293	6.69007
	Equal variances not assumed			8.568	91.631	.000	5.43200	.63396	4.17293	6.69117



## DISCUSSION

We are experiencing more and more disasters these days, claiming thousands of lives as they occur suddenly and with great magnitude, thereby causing considerable damage. These disasters can be natural or manmade like earthquakes, floods, wars or riots etc.

Making personal identification the need of the hour. Identification of a person mainly depends upon age sex and race.

In our study we observed that the intercanine widths and Intermolar widths were less in females than for males. It was also observed that the intercanine widths and the intermolar widths were more for Punjabi population residing in Uttarakhand than the native population for both males and females respectively. Thus exhibiting that ICD and IMD can be used as a tool for sexual dimorphism.

Our results are in accordance with other previous studies Astete et al,<sup>[6]</sup> concluded in their study that the mean values for maxillary intercanine and

intermolar distances for females were less than for males. Our study also gave a similar result. These findings might be due to the fact that dental arch width reflects the size of the basal bone. The males in general have larger basal bone than females, so the same might be applicable to the basal bone of the jaws and dental arches.<sup>[8,9]</sup> Teschler-Nicola and Garn et al concluded that the canine index was higher in females as compared to males due to less mesiodistal width and intercanine width in females.<sup>[10,11]</sup> Omar and Azab and Kaushal et al concluded that the mandibular canines showed higher percentage of sexual dimorphism.<sup>[12,13]</sup> Same was concluded in the studies of Garn et al,<sup>[14]</sup> and Anderson and Thompson.<sup>[15]</sup>

## CONCLUSION

Odontometric study was carried out in 100 subjects to identify gender and ethnicity.

It was concluded that intercanine distance and intermolar arch widths can also be used to differentiate between the native and Punjabi population of Uttarakhand.

This is a comparatively inexpensive and easy means of identification of persons from fragmented jaws and dental remains. Thus the presence of canines and first molars in arches render great help in forensic dentistry, thus maintaining law and rendering justice.

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