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Inter-canine distance for gender determination in adolescence

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Abstract:

This study aimed to utilize the canine tooth's robust nature and distinct characteristics for gender identification purposes, especially in the context of anthropological and forensic investigations. The inter-canine distance was highlighted as a key factor for examination due to its confirmed potential as a reliable indicator of gender.

Our investigation involved a total of 200 individuals hailing from Salahaldin, Tikrit, aged between 11 and 16 years. The gender composition of the sample consisted of 88 males and 112 females. We employed a digital vernier caliper during direct intra-oral examinations on participants with normal occlusion. This enabled us to measure the inter-canine distances for both the maxilla and mandible accurately.

Utilizing a T-test for our statistical analysis, we discovered highly significant differences in the inter-canine distances across genders, with a p-value less than 0.01. The data demonstrated that the inter-canine distances for both the maxillary and mandibular regions were noticeably larger in males than females, indicating prominent gender dimorphism within this dental attribute.

These results underline the value and potential accuracy of inter-canine distance measurements for determining gender, especially in anthropological and forensic fields. These findings support further exploration and validation of these measurements as reliable, non-invasive, and cost-effective tools for gender identification.

Key : Anthropology, Canine Teeth, Inter-Canine Distance, Gender Identification, Dental Examination, Gender Determination, Maxillary and Mandibular Measurements.

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Introduction:

Identifying individuals based on unique physical features is crucial in various contexts, such as court cases and mass disaster incidents. One of the most resilient and identifiable parts of the human body is the tooth, due to its resistance to decomposition and microbial degradation (Singh et al., 2017). Therefore, dental tissue

is an invaluable resource for forensic investigations, especially when other body parts are unavailable or too damaged.

A significant determinant in dental identification is gender dimorphism - the variations in size and form between male and female teeth. This is particularly evident in mandibular canines, which are less affected by plaque, calculus, and periodontal disease, and tend to be the last teeth to be lost due to aging (Patel et al., 2017).

The durability of enamel - the hardest known substance in the human body - allows canine teeth to resist trauma, making them ideal for use in postmortem investigations. Previous studies have highlighted the inherent dimorphic variations in human teeth (Bashir et al., 2016).

One crucial parameter in these investigations is the inter-canine distance. As the impressions of anterior teeth are typically the most clear and measurable, their examination can provide key insights (Tedeschi-Oliveira et al., 2011). A bite mark with an inter-canine distance less than 2.5 cm suggests it belongs to a child. In contrast, a distance of 2.5 to 3.0 cm might belong to a child or a small adult, and anything above 3.0 cm is likely from an adult (Paulino et al, 2011).

Osman et al. (2021) studied the correlation between facial measurements and various dental dimensions, including inter-canine distance, in the Egyptian population. The results confirmed that males generally have larger facial dimensions than females, providing another critical aspect of gender differences in forensic dentistry.

In this context, the present study aims to explore the role of inter-canine distance in establishing gender identity during adolescence.

Materials & Methods:

This study comprised of 200 volunteer participants from Tikrit, Salahaldin, Iraq, including 88 males and 112 females aged between 11-16 years old. The study was conducted from February to April 2022. All participants were assured of data confidentiality, and it was clarified that the collected information would only be utilized for research purposes, thereby ensuring respect for their privacy.

Inclusion criteria for the study were defined as follows:

Individuals with a healthy periodontium

Participants with caries-free canine teeth

Participants with a Class I canine relationship

Exclusion criteria were also established:

Individuals

with carious or missing maxillary or mandibular canines

Presence of spacing and crowding in mandibular or maxillary anterior teeth

Individuals with Class II or Class III malocclusion

Non-eruption of canines



Fig(1):-digital vernier caliper

Measurement-of all samples of inter-canine distance inside the patients mouth for each of males and females the C-C distance was measured from the cusp tip of right and left mandibular and maxillary canine using digital vernier caliper. Statistical analysis used to assess the Inter canine distance.

Fig(2):-maxillary intercanine measurement.



Fig(3):-mandibular intercanine



measurment

Results:

The comparison of dental measurements between males and females aged 11-16 was accomplished using descriptive statistics, with the results presented in terms of mean values and standard deviations. T-tests were utilized to assess the differences between genders.

Table 1 reveals a highly significant difference ($p < 0.01$) between males and females regarding the maxillary canine-canine (C-C) distance. The male group showed a mean value of 36.70 ± 3.47 mm (SD) for the maxillary C-C distance, which was significantly greater ($t = 2.43^{**}$, $p < 0.01$) than the female group's mean value and standard deviation of 34.83 ± 3.76 mm.

As for the mandibular C-C distance, presented in Table 2, the mean value for males was 30.14 ± 3.08 mm. This value showed a highly significant difference ($t = 3.02^{**}$, $p < 0.01$) when compared to the mean value for females, which was 27.86 ± 3.98 mm (SD).

Moreover, an intra-individual comparison between the maxillary C-C and mandibular C-C distances in both males and females revealed that the maxillary C-C

measurements were consistently larger. This finding supports the assertion that the transverse measurement of the anterior segment of the maxilla is greater than that of the mandible in the same individuals, regardless of their gender.

Table 1: Mean and Standard Deviation of Maxillary Inter-Canine Distance (in mm) by Gender

Teeth Chart	Sex	Number	Mean \pm SD
C-C	M	88	36.70 \pm 3.47
	F	112	34.83 \pm 3.76

T-Value = 2.43**, n= (P>0.05), *(P<0.05), **=(P<0.01)

Table 2: Mean and Standard Deviation of Mandibular Inter-Canine Distance (in mm) by Gender

Teeth Chart	Sex	Number	Mean \pm SD
C-C	M	88	30.14 \pm 3.08
	F	112	27.86 \pm 3.98

T-Value = 3.02**, n= (P>0.05), *(P<0.05), **=(P<0.01)

Discussion:

This study sought to analyze the arch width through measurement of inter-canine distances in both the maxilla and mandible among male and female subjects. The findings indicate that these measurements were consistently larger in males than females, which aligns with existing literature on this topic.

Thilander (2009) studied the dentoalveolar development in Swedish individuals aged 5-31 years who exhibited 'ideal' or normal occlusion. Thilander found that all canine-canine (C-C) measurements were larger in males than females, corroborating our findings.

Similarly, Louly et al. (2011) evaluated dental arch dimensional changes in Brazilian children aged 9-12 years. Their findings agreed with our study, showing larger maxillary C-C distances in males for the 9 and 10-year-old groups. However, at the age of 11, they found a slight increase in female C-C distances, which contradicts our results.

A longitudinal study by Sangwan et al. (2011) on an Indian population aged 4-5 years showed that both initial and follow-up measurements of maxillary and mandibular C-C distances were larger in males, despite the lack of statistical significance in gender difference. This trend still aligns with the results of our study.

In a cross-sectional study conducted by Singh et al. (2021) on Indian adolescents aged 12-17 years, they found the mean C-C width in males was larger than females, supporting the findings of our study.

Likewise, Khera et al. (2012) conducted a study on 90 subjects, aged 17-24 years, from the outpatient department of the Department of Orthodontics and Dentofacial Orthopedics in India. They found that both maxillary and mandibular C-C measurements were larger in males, further substantiating our findings.

In summary, the greater inter-canine distances observed in males across different age groups and ethnicities highlight a consistent trend in dental development, underscoring the value of these measurements in forensic and orthodontic contexts.

Conclusions:

Transverse measurements of jaws in male generally larger than female. Maxillary inter-canine width in male larger than female. Also, Mandibular inter-canine width in male larger than female. Finally, IN normal class I occlusion always the maxillary inter-canine width is larger than mandibular inter-canine width in the same individual.

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Noor Ghazi saab / Afr.J.Bio.Sc. 5(3) (2023) 32-37

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