Original Article

CORONO-CONDYLAR DISTANCE: A NOVEL INDICATOR OF CHRONOLOGICAL AGE – A DIGITAL RADIOGRAPHIC STUDY

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ABSTRACT

Age is an important factor in establishing the identity of an individual. Facial bones are maturational indicators that provide useful information regarding growth changes. They undergo a series of changes from prenatal to postnatal life and continue into senile life. They are also extremely resistant to fire and remain undecomposed even after an extended period of burial. If the entire adult skeleton is procured, the age and sex can be determined with maximum accuracy. However, in case of mass disasters where only fragments of bone are available for analysis, the evaluation becomes cumbersome.

Several studies have been conducted on the dry adult skull using various parameters for age and sex determination. However, not many studies have been done to determine the age of an individual using the corono- condylar distance. There are not many studies done using the Orthopantomogram as well.

This study aimed to assess the use of corono-condylar distance for age estimation using an Orthopantomogram. In our study, we observed that there was an increase in the corono-condylar distance with an increase in age. This can be used as a novel radiographic method for age estimation.

Key words: Corono-condylar distance, Age estimation, Forensic odontology, Chronological age, Digital radiograph.

Introduction

Forensic odontology is a branch of dentistry that involves the inter-relationship between dental sciences and law [1]. It has been defined as " that branch of forensic medicine which in the interest of justice deals with the proper handling and examination of dental evidence and with the proper evaluation and presentation of the dental findings" [2, 3]. Under this discipline, the dentist plays a small but highly significant role in crime scene investigation and disaster or accident victim identification. Other important roles include identification of suspected abuse through bite marks or physical injuries and determining of age and gender of an individual to testify as an expert witness in the court to present dental evidence [4, 5].

The identification of humans is done based on antemortem dental records or by profiling post-mortem records in cases where antemortem data is unavailable [6, 7]. Dental identification has been vital in identifying deceased individuals since 66 AD [8]. However, the first case was accepted by the judiciary in the United States in the year 1849 [9].

Age is an important factor in establishing the identity of an individual [10]. Facial bones are maturational indicators that provide useful information regarding growth changes [3]. They undergo a series of changes from prenatal to postnatal life and continue into senile life. They are also extremely resistant to fire and remain undecomposed even after an extended period of burial [11]. If the entire adult skeleton is procured, the age and sex can be determined with 100 % accuracy [12]. However, in the case of mass disasters where only fragments of bone are available for analysis, the evaluation becomes cumbersome [13, 14].

Several studies have been conducted on the dry adult skull using various parameters for age and sex determination. However, not many studies have been done to determine the age of an individual using the corono- condylar distance. There are not many studies done using the orthopantomogram as well.

This study aims to assess the use of corono-condylar distance for age estimation using an orthopantomogram (OPG).

Materials and Methods

For the present study, a total of 100 Orthopantomograms were procured from the Department of Oral and Maxillofacial Radiology. The radiographs were divided into 5 groups, with 20 OPG's in each group. The groups were made based on age, with the age range in each group being 10 years. (Group 1- 10 to 19 years, Group 2- 20 to 29 years, Group 3- 30 to 39 years, Group 4- 40 to 49 years, Group 5- 50 to 59 years).

The corono- condylar distance on the right and left sides was measured using the viewing software Planmeca Romexis

Viewer ver 4.5.0.28. The highest point on the condyle and the coronoid was determined by drawing a tangent to them. Then the distance between the two points was measured using the ruler tool **(Figure 1)**. The distance was measured in millimeters (mm).

Figure 1. An OPG showing the corono-condylar distance measured using the software tool

The data was tabulated. For statistical analysis, the mean and standard deviation of each group was calculated using IBM SPSS software version 20.

Results and Discussion

The mean corono-condylar distance on the left side ranged from 50.15 ± 4.14mm for the age group of 10-19 years to 53.87 ± 2.43mm for the age group of 50-59 years. On the right side, it ranged from 51.83 ± 7.31 mm for the age group of 10-19 years to 54.55 ± 4.94 mm in the 50-59 years group. There was an increase in the mean corono- a condylar distance of the left and right side by 3.72 mm and 2.72 mm, respectively, between the age group of 10 to 59 years **(Table 1)**.

Table 1. Mean corono- condylar distance on the right and left side

Age group (in years)	CCD Left (in mm)	CCD Right (in mm)
10-19	50.15 ± 4.14	51.83 ± 7.31
20-29	51.73 ± 4.49	52.93 ± 2.32
30-39	52.70 ± 3.56	53.88 ± 4.66
40-49	53.55 ± 6.77	53.98 ± 3.32
50-59	53.87 ± 2.43	54.55 ± 4.94

Note. CCD = Corono-condylar distance

In the present study, there was an increase in the mean corono- a condylar distance of the left and right side by 3.72 mm and 2.72 mm, respectively, between the age group of 10 to 59 years. As age advances, resorption exceeds formation, resulting in overall bone loss [9]. Mohite *et al*. suggested that, as age advances, the number of osteons decreases with age and is replaced by marrow tissue [14, 15]. The mandible grows in a posterior superior direction resulting in an anterior inferior displacement. This leads to an increased gonial angle, as described by Dhaka *et al*. [3]. This may lead to an increase in the corono- condylar distance.

In our study, we observed that the increase in the mean corono- condylar distance on the right side exceeds that of the left side, by 1mm. This could be due to the differential growth of the mandible. It can also be attributed to the increased condylar path inclination angle on the right side (81.87%) than on the left side (78.85%).

Conclusion

This is a novel technique of age estimation using corono-condylar distance by OPG. Further studies with larger sample sizes are needed to standardize the results and formulate an equation for age estimation using the corono-condylar distance.

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Conflict of interest: None

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Ethics statement: The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Individual consent for this retrospective analysis was waived.

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