Original Article

Establishing the reliability of incisive papilla and palatal rugae patterns in individual identification

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Abstract

Context: The study of palatal rugae forms an important basis of human identification, especially due to mass disasters where routinely used techniques may not be helpful.

Aims: This study aimed at evaluating the palatal rugae and incisive papilla on the basis of shape.

Settings and Design: The study was conducted in 280 individuals (males and females) among dental students of Dayananda Sagar College of Dental Sciences.

Materials and Methods: The study included 280 students from Dayananda Sagar College and out-patients from the orthodontics department. Pictures of rugae and the incisive papilla were taken from individuals aged 10–36 using a camera, mirror, and lighting. Two investigators analysed the shape of the rugae and incisive papilla using classification systems by Thomas and Kotze, and Ortman and Tsao, respectively.

Statistical Analysis Used: The data were statistically analysed using SPSS 20.0 software, and a significance level of $P \leq 0.05$ was used.

Results: The results suggested that rugae showing a wavy shape were the most common pattern in both the genders. Significant differences were observed in the curved rugae type between males and females. In incisive papillae evaluation, the pear shape was the most common, with the triangular shape being the least common.

Conclusions: It can be concluded that evaluation of palatal rugae along with the incisive papilla can be an important tool for identification of an individual and for evaluating various ethnic populations.

Keywords: Dental sciences, ethnic populations, incisive papilla, palatal rugae

INTRODUCTION

Forensic dental identification is an important tool in the field of forensics. It involves the analysis of dental records and evidence to help identify deceased individuals. It is a vital component in criminal investigations, disaster victim identification, and other areas.[1]

In the event of major catastrophes, where bodies are frequently too severely mutilated to be recognised, determining the gender of the victim is of great importance. By pre-determining the sex, it allows for the creation of a biological profile of the unidentified human remains, thereby decreasing the number of potential missing people by half.[2]

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International Criminal Police Organization (INTERPOL) has designated forensic odontological comparison as one of the three main identifiers for identifying the casualties of a multi-casualty incident. It is deemed to be a reliable enough method that personal identification can be made without the need for supplementary techniques.[3]

Palatal rugae and incisive papilla are not affected by environmental factors or lifestyle or age, making them reliable and accurate in forensic science. Furthermore, their location in the oral cavity shields them from trauma and extreme heat.[4]

The goals of this study were
1. To compare the palatal rugae patterns and shape of incisive papilla between males and females.
2. To investigate if the palatal rugae pattern and shape of incisive papilla can be used as an indicator of sex.

MATERIALS AND METHODS

The research sample comprised 280 students from Dayananda Sagar College in addition to out-patients who sought treatment at the department of orthodontics, who were also included in the study. Of them, 200 were females and 80 were males.

Prior to participating in the study, all subjects were provided with a consent form and their confidentiality was ensured by maintaining their personal information anonymous.

Inclusion criteria
Only healthy individuals free from any congenital malformation, inflammation, or trauma were included in the study.

Exclusion criteria
The study did not include subjects who had congenital anomalies or medically compromised conditions.

The individuals aged 10–36 were directed to the Department of Oral Pathology. They were comfortably seated on a dental chair, and pictures of rugae and the incisive papilla were captured with the aid of a Canon 1500D camera, a dental mirror, and sufficient lighting.

Two investigators, a forensic odontologist and an oral pathologist, took turns in analysing the shape of incisive papilla and rugae. The classification of rugae patterns was executed by utilising Thomas and Kotze's classification system, whereas Ortman and Tsao's classification method was utilised for categorising the shape of the incisive papilla.

[Figure 6] Thomas and Kotze (1983) classification of shape of rugae was employed for the identification of the palatal rugae pattern.[5]
1. Curved
2. Wavy
3. Straight
4. Circular.

[Figure 7] Ortman and Tsao's classification was employed for identification of the shape of incisive papilla.[6]
1. Pear
2. Oval
3. Irregular
4. Triangular
5. Inverted pear
6. No papilla.

The data thus obtained were documented in profoma, and statistical analysis was done using ISPSS 20.0 software. Chi-square test was performed to compare the data obtained. A 'P' value of ≤ 0.05 was considered to be statistically significant.

RESULTS

This cross-sectional study was conducted on a study sample of 280 participants. Among the total 280 study participants, the majority of them were females, representing 200 (71.4%), and 80 (28.6%) were males [Figure 1]. A total of 280 rugae and incissive papilla were observed in the entire study population. The shape of incisive papilla was evaluated, depending on the shape – pear, oval, irregular, triangular, inverted pear, or no papilla. This shows that the pear shape was the most common, with the triangular shape being the least common. The result is shown in Figure 2. The study population was also analysed based on the shape
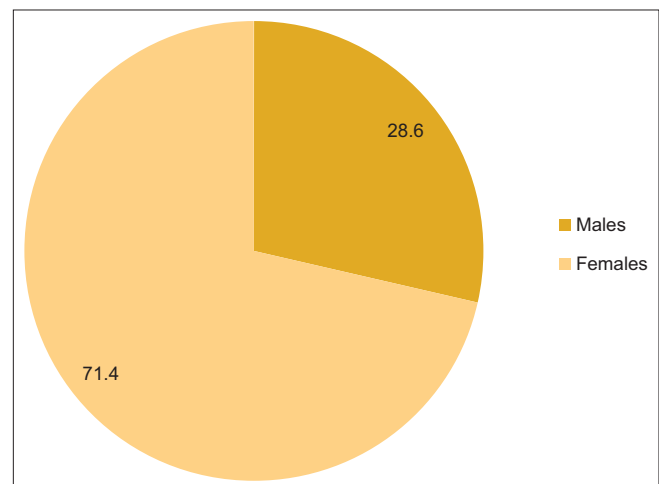

Figure 1: Distribution of study population

of the incisive papilla and gender. These findings suggest that there is a variation in the shape of the incisive papilla among different genders, with pear and oval shapes being more common than other shapes. The result is shown in Figure 3.

The palatal rugae were assessed on the basis of shapes and evaluated according to the classifications of curved, wavy, straight, and circular. These data clearly indicate the curved pattern (72.1%) to be the highest and the circular pattern to be the lowest (0.4%). The result is shown in Figure 4. The distribution of the study population was also analysed based on the shape of rugae and gender. The results showed that the majority of individuals in both genders had curved rugae, with 57 individuals (71.25%) in the male group and 145 individuals (72.5%) in the female group. The result is shown in Figure 5.

DISCUSSION

This study was conducted to assess the prevalence of incisive papilla and rugae patterns and to investigate the use of these patterns in gender determination as an important forensic tool for identification of an individual.

The field of Forensic Odontology pertains to the application of dental knowledge in the examination,

analysis, and interpretation of dental evidence for legal purposes, thereby facilitating the fair administration of justice.[7]

The application of various forensic odontology techniques aids in the identification of human remains in events such as terrorist attacks; airplane, train, and road accidents; fires; mass murders; and natural disasters such as tsunamis, earthquakes, and floods through the process of disaster victim identification (DVI). The dental structures are among the most robust and well-protected structures in the body, which endure decomposition and high temperatures, and are one of the last structures to deteriorate after death. The fundamental basis of dental identification lies in the fact that no two oral cavities are identical, and the teeth possess unique features that are distinctive to an individual.[8]

In forensic identification, palatal rugae have a significant role due to their post-mortem resistance and stability. The unique morphological pattern of these rugae proves to be useful in forensic investigations, especially in cases of
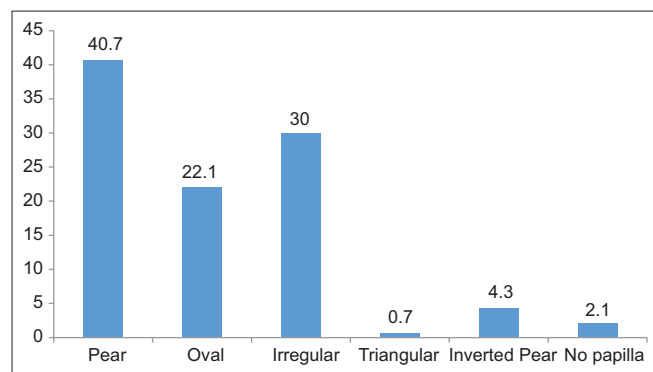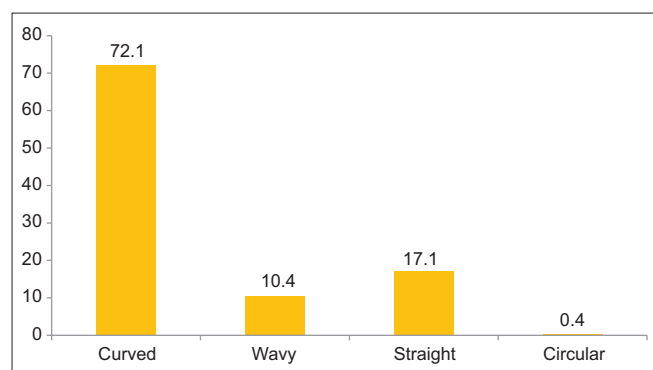

Figure 2: Shape of incisive papilla

Figure 3: Shape of incisive papilla and gender
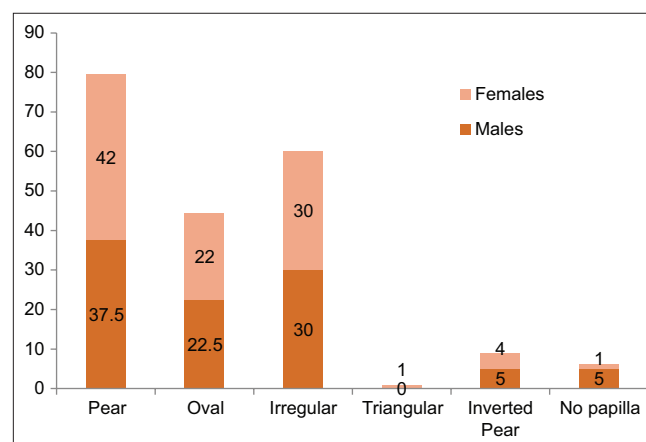

Figure 4: Graph showing shape of palatal rugae
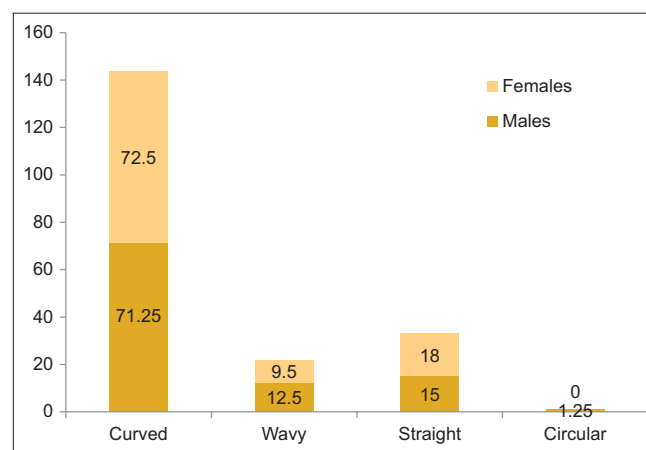
Figure 5: Study population based on shape of rugae and gender

Figure 6: Shape of palatal rugae

1	Curved
2	Wavy
3	Straight
4	Circular

Figure 7: Shapes of incisive papilla

Type 1	Pear
Type 2	Oval
Type 3	Irregular
Type 4	Triangular
Type 5	Inverted pear
Type 6	No papilla

mutilation, as it aids in differentiating them from other body parts. Additionally, since rugae patterns can be specific to particular racial groups, they are helpful in population identification.[9,10]

Palatal rugae also serve as a tool for characterising and comparing various ethnic populations as evident from the various studies done world-wide. In addition to the various patterns of palatal rugae, the incisive papilla can also contribute in this aspect of identification of individuals and characterisation of different populations.

In our study, evaluation of rincisive patterns shows that the pear shape was the most common, with the triangular shape being the least common. There is a variation in the shape of the incisive papilla among different genders, with pear and oval shapes being more common in females compared to males than other shapes. The palatal rugae were assessed on the basis of shapes and evaluated according to the classifications of curved, wavy, straight, and circular. These data clearly indicate the curved pattern (72.1%) to be the highest and the circular pattern to be the lowest (0.4%).

The distribution of the study population was also analysed based on the shape of rugae and gender. The results showed that the majority of individuals in both genders had curved rugae, with 57 individuals (71.25%) in the male group and 145 individuals (72.5%) in the female group.

Pakshir F and Ajami S *et al*. research conducted on the Iranian population revealed that the wavy rugae shape was the most prevalent among both sexes, which contrasts with our study on the Indian population, where the curved pattern was found to be the most common shape in both sexes.[11]

CONCLUSION

The assessment of rugae patterns and the incisive papilla shape of students of Dayananda Sagar Dental College suggests that the wavy shape of palatal rugae is the most prevalent type, showing no significant differences between males and females. Incisive papilla exists in a pear form in most of the individuals. Thus, evaluation of the rugae pattern along with incisive papilla methods serves as an important alternative for the identification of an individual, providing a significant contribution in cases of criminal investigation as well as in mass disasters.

Palatal rugae and incisive papilla can be used as an effective tool in forensic identification. Its internal position, antemortem resistance, uniqueness, and regional variation provide a potentially reliable source of identification to the researchers. However, these interpretations are precluded by the small sample size, and further research work on larger samples and application of advanced statistical methods is required to validate its use in forensic application.

Limitation of the study

The study was conducted among students enrolled in DSCDS, resulting in a diverse age range. However, the gender distribution in the field of dentistry is imbalanced, with more females than males, which led to an uneven proportion of male and female participants in the study. This gender discrepancy is a limitation that should be acknowledged.

Conflicts of interest

There are no conflicts of interest.

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