Palatoscopy: A way to discover victim's identity in mass disaster

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Abstract

Forensic dentistry or odontologyis the implementation of the knowledge regarding the dentalaspects in criminal cases and mass disaster where individual identification is done by the individual's dental records. Palatoscopy is one of the method for DVI (disaster victim identification) used in forensics. The principal behind identification via dental records lies in the fact that no two oral cavities are same. Hence the teeth, rugae, any pathologies or anomalies are unique to an individual. In this article we will discuss about Palatoscopy, its role in DVI and why it is preferred.

Keywords: Forensic odontology, Palatoscopy, Disaster victim identification, Rugae.

Introduction[1]

Palatoscopy also known as palatal rugoscopy is the study of palate, rugae to determine the identity of a person. Rugae are the anatomical folds that are located on the anterior third of palate behind the incisive papillae. They are also known as "Plica palatine". It can be used in fields like gender determination, orthodontics and forensics.

Palatoscopy leads to valid conclusions pertaining to identification of a person.

Other methods in forensic odontology
1. Cheiloscopy
2. Tongue prints
3. Amelogyphics
   Winslow in 1732 described rugae as a permanent feature on the hard palate. For personal identification use of palatal rugae was suggested by Allen in 1889.[1]
   Various classification of palatal rugae as follows-
I. Lysell classification:[1]
Depend on length of palatal rugae its classified into-
   a. Primary rugae - length of more than 5 mm
   b. Secondary rugae - length between 3-5 mm,
   c. Fragmentary rugae -length between2-3 mm.
   d. Smaller than 2mm in length are discarded.
II. Thomas and kotze classification-[1]
1. Rugae dimension and prevalence:
   a. Length - determined according to latest rugae dimension and is classified as primary, secondary or fragmentary rugae
   b. Prevalence- rugae is determined by counting and recording the number in each category (primary, secondary and fragmentary) and not the total number on each side.
   c. Area – determination of the surface area of the primary rugae.
2. Primary rugae details:
   a. Can be described as annular, papillary, crosslink, branches, unification, breaks, unification with non primaryrugae.
3. Rugae pattern dimensions:

   a. Distance between most anterior point on incisive papilla and most anterior point on rugae pattern regardless of the side.
   b. Distance between incisive papilla to posterior border of last primary or secondary rugae
   c. Distance between incisive papilla to the posterior border of last rugae
4. Angle of divergence:
   a. Measured in degree between the line formed by the medial palatal raphe and line joining incisive papilla with the origin of most primary or secondary rugae on one side of palate.
5. Dental arch and palate dimensions:
   a. Width- line joining the mesio-palatal cusp of permanent maxillary first molar or deciduous second molar is used to project a point below and perpendicular to it on the gingival margin to determine the width.
   b. Depth – point below and perpendicular to line joining the tips of mesiopalatal cusp of permanent maxillary first molar or deciduous second molar on the midpalatal raphe is used to determine the depth.
   c. Center – perpendicular distance between the line joining the tips of mesiopalatal cusp of permanent maxillary first molar or deciduous second molar and the point on midpalatal raphe determines the center.
III. Kapali et al classification[1]–
   The rugae were divided into 4 types based on their shape as:
   a. Curved - They had a crescent shape and curved gently.
   b. Wavy -If there was a slight curve at the origin or termination of curved rugae. Straight -They run directly from their origin to termination.
   c. Circular- Rugae that form a definite continuous ring were classified as circular.
IV. Trobo classification[1]-
Palatal rugae classified into 2 types-
   a. Simple - Rugae shapes are well defined, and further subdivided into A,B,C,D,E,F.

   b.   Compound-Rugae were formed by union of two or more simple rugae and classified as type X
1. Type A- Point
2. Type B- Line
3. Type C- Curve
4. Type D- Angle
5. Type E- Sinuous
6. Type F- Circle

V. Lima classification (1968)[1]-

He classified rugae into 4 main types-
   a. Punctuate
   b. Straight
   c. Curved
   d. Composite

Why palatoscopy preferred over other methods of identification?[2]

The patterns of palatine rugae exhibit racial and gender variations where they are not subjected to gross changes except in the length during the person's growth. They are protected from trauma and other extreme conditions like high temperatures as they are shielded by the lips, cheeks, tongue, teeth and bone and retain the same position and shape throughout the person's life once formed. They also serve as a valuable tool in the conditions where finger prints or lip prints cannot be recorded like decomposed or burnt bodies. Its importance is justified by using it in the identification of pilots in aeronautical accidents with the aid of antemortem data.

The rugae is least susceptible to the catastrophic changes and help in collection of dental evidence.[3]

For the successful results of palatoscopy, antemortem dental records are required. In cases where previous records are not available for comparison, an alternative aid used for individual identification is radiograph. The radiographic images of the deceased can be obtained and compared with the available antemortem radiographic image of the suspected person.[4]

Method to identify the victim via palatoscopy-
1. Impression of maxillary arch is made focusing on the rugae area. The cast is poured and with lead pencil the rugae area is marked.
2. No. of rugae on left and right side of mid palatine raphe is recorded.
3. Size of each rugae is measured using a divider and a scale by measuring the length from one end to the another end of rugae.
4. Shapes of rugae analysed according to the classification given above.
5. Lastly the length, number and shape of rugae are matched with the victimsantemortem dental records.

Digital methodology in palatoscopy[5]

It is often difficult to obtain dental arch impressions of corpses that arrive at the Forensic Medicine Institutes to be compared with the antemortem data of the alleged victim. As the experts or technicians are not familiar with dental impression materials and there is no dental laboratory structure, photographs are more practical. Antemortem models can be obtained from the victims' dentists and then compared with the postmortem photographs using free image-editing software, which is more practical and economically feasible for the Brazilian Forensic Medicine Institutes.

A digital method for human identification using palatal rugoscopy by comparing photographs of the palate with images of maxillary cast models photographed with and without the palatal rugae.

Superimposition of various digital photographs for comparing rugae pattern can be performed using various computer softwares. Following are the digital ways for studying the pattern of rugae.
1. Stereoscopy, can obtain a three dimensional image of palatal rugae anatomy. It is based on examination of two pictures taken with the same camera, from two different points using special equipments. Superimposition of various digital photographs for comparing rugae patterns can be performed using various computer software. E.g, RUGFP-ID, palatal rugae comparison software (PRCS version 2.0).
2. Calcorrugoscopy or overlay print can be used to perform comparative analysis.
3. Sterophotogrammetry which by using special device called traster marker allows for correct determination of length and position of every single rugae.

Conclusion

Forensic odontology is that specialisation of dentistry which consists of numerous of tools that are helpful in an individual's identification. Palatoscopy is preferred over other tools for genderdetermination as there are no major changes throughout the lifespan of an individual after its development and it is well protected from trauma due to its anatomy. Thus, dental records of a person should be preserved by the dentist for successful results. Even if there are no antemortem dental records, forensic can perform palatoscopy via various computer software mentioned above. After any mass disaster identifying the victims become difficult. Hence, identifying via forensics the victim's identity is accurately established.

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Conflict of interest

None.

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