



Content available at: <https://www.ipinnovative.com/open-access-journals>

IP International Journal of Forensic Medicine and
Toxicological Sciences

Journal homepage: <http://www.ijfmts.com/>



Review Article

Palatoscopy (Rugoscopy) assistance in forensic investigations

Avineet Kaur^{1,*}, Shalika², Harnoor Singh Sandhu³, Reshma Dodwad⁴,
Mehraab Kaur Dhillon⁵, Simmerpreet J Mann⁶

¹Dept. of Periodontology, Swami Devi Dyal Hospital and Dental College, Golpura, Haryana, India

²Dept. of Dermatology, Gian Sagar Medical College & Hospital, Banur, Rajpura, Punjab, India

³Dept. of Emergency, Gian Sagar Medical College & Hospital, Banur, Rajpura, Punjab, India

⁴Dept. of Pedodontics and Preventive Dentistry, Krishna Devaraya College of Dental Sciences, Bangalore, Karnataka, India

⁵Dept. of Dentistry, SKSS Dental College, Ludhiana, Punjab, India

⁶Dental clinic, Gillco Parkhills, Mohali, Punjab, India



ARTICLE INFO

Article history:

Received 01-05-2021

Accepted 17-05-2021

Available online 24-07-2021

Keywords:

Palatoscopy

Rugoscopy

Rugae pattern

Identification

ABSTRACT

Human identification is most challenging field in forensics. Scrutiny of the fingerprints, teeth and DNA comparison are commonly used techniques, thus allowing quicker and secure fast and identification processes. Palatal rugae markings are unique to an individual and are stable throughout the life. Rugae don't undergo any changes apart from in length throughout the life. Thus palatoscopy or palatal rugoscopy is used as an aid in forensic investigations.

© This is an open access article distributed under the terms of the Creative Commons Attribution License (<https://creativecommons.org/licenses/by/4.0/>) which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

1. Introduction

Palatal rugae, termed as “plicae palatinaetransversae” and “rugae palatine” denote to the elevations on the frontal part of the palatal mucosa, each side of the median palatal raphe and beyond the incisive papilla. According to Glossary of Prosthodontics rugae are anatomical folds or wrinkles usually the irregular fibrous connective tissue located on the frontal third of the palate. Palatoscopy or palatal rugoscopy is the study of palatal rugae in order to establish a person's identity. Palatoscopy gives a fairly valid conclusions pertaining to person's identification. As human identification is necessary in all social and legal aspects.¹

1.1. Development of rugae

Palatine rugae develops during third month of intrauterine life its growth is controlled by epithelial mesenchymal

interactions. First rugae are developed in embryo of 32 mm following incisive papilla in prenatal stage. Once papillae are formed size may change as palate grows, but shape remains the same.²

2. History^{2,3}

2.1. Classification of palatal rugae²⁻⁴

Goria in 1911 developed first system of categorizing. He categorized rugae pattern into bilateral

1. Number of rugae
2. Extent of rugae zone.

It is distinguished into two types ie both primitive and more developed.

Lysell's classification in 1955 was most important and used widely in research Rugae are categorized into three categories

1. Primary 5 mm or more

* Corresponding author.

E-mail address: Kauravineet85@gmail.com (A. Kaur).

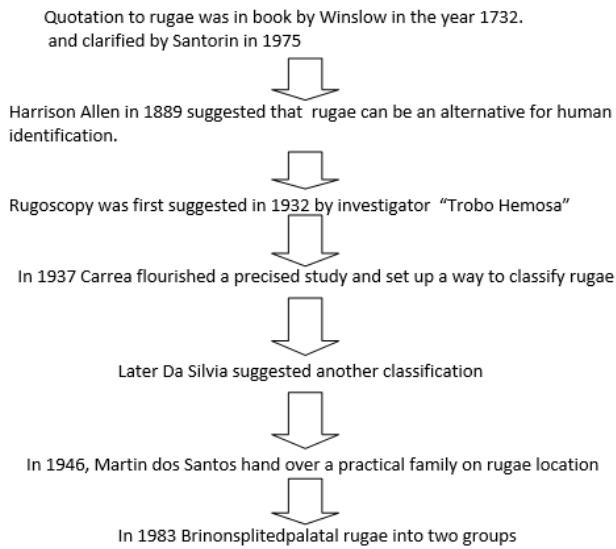


Fig. 1:

2. Secondary 3 to 5 mm
3. Fragmentary 2 to 3 mm
4. Rugae smaller than 2 mm are disregarded

Trobo in 1932 categorized into two groups

- Simple rugae shapes are well-defined and split into Type A,B,C,D,E,F.

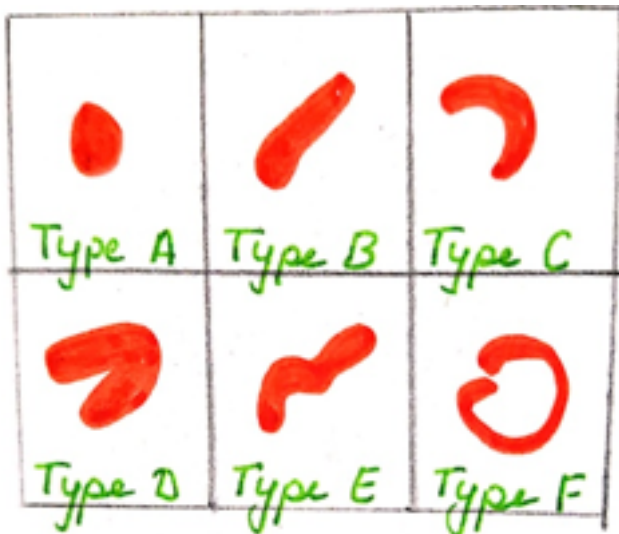


Fig. 2: Robo classification

- Compound rugae are classified as "Type X" or Polymorphism type.

Table 1:

Classification	Rugae type
Type A	Point
Type B	Line
Type C	Curve
Type D	Angle
Type E	Sinuuous
Type F	Circle

3. Rugae Type

3.1. Thomas and Kotze classified as

1. Branched
2. Unified
3. Cross linked
4. Annular
5. Papillary

3.2. Classification by Bassuri

1. 0 pointed
2. 1 straight
3. 2 curved
4. 3 angled
5. 4 sinuous
6. 5 circular
7. 6 Greek
8. 7 Calyx shaped
9. 8 racket
10. Branched

3.3. Lima classification

1. Punctuate
2. Straight
3. Curved
4. Composite

3.4. Kapali et al in 1997

1. Curved
2. Wavy
3. Straight
4. Circular

3.5. Modification of kapali's classification

1. Converging
2. Curved
3. Straight
4. Circular Furcated
5. Wavy

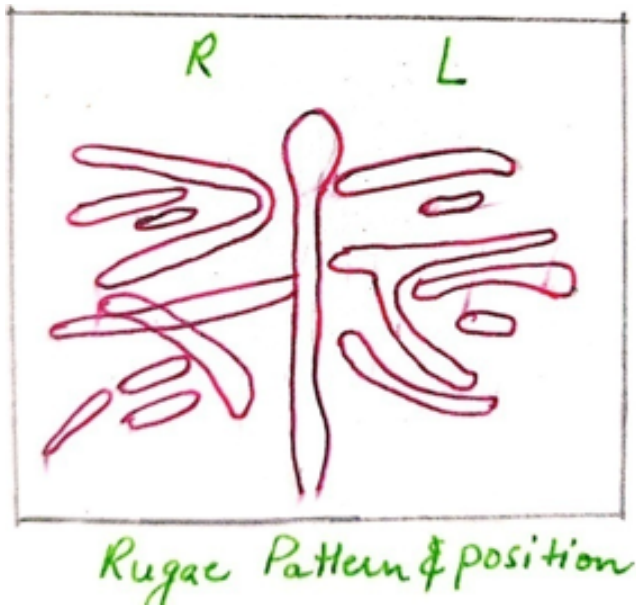


Fig. 3: Lima classification

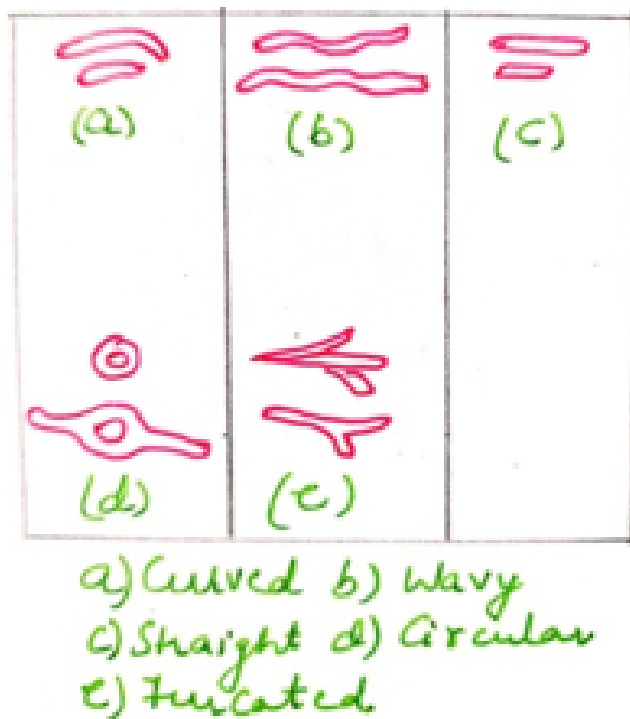


Fig. 4: Modification of kapali's classification

3.6. Carrea classification based on form of palatal rugae

1. Type I Posterior Anterior Directed rugae
2. Type II Rugae perpendicular to raphe
3. Type III Anterior Posterior Directed rugae
4. Type IV Rugae directed in several directions

3.7. Da Silva Classification

Palatal rugae classified into two types

1. "Simple" numbered from 1-6
2. "Composed" resulting from combinations of 2 or more rugae patterns

3.8. Classification Rugae type

Table 2:

Classification	Rugae Type
1	Line
2	Curve
3	Angle
4	Circle
5	Wavy
6	Point

4. Methods to Collect Palatal Rugae^{5,6}

Impressions are being taken using alginate as impression material Impression of palatal arch was prepared and dental stone was poured. Tracing of the rugae pattern was done with the help of sharp 5 HB graphite pencil under light . Now with the help of magnifying lens casts were explored thoroughly and further rugae are classified according to classification

Task of Palatal rugae³

1. To ease food transportation through oral cavity
2. Because of gustatory and tactile receptors there is presence of taste.

4.1. Clinical significance^{1,3}

4.2. Divergence of rugae pattern according to ethnicity

There seems to be compelling linkage between rugae forms and ethnicity. Kapali et al. calculated the palatal rugae markings in Australian Aborigines and whites and found that number of primary rugae were higher in Australian than in whites.

4.3. Burn cases

Muthusubramanian et al. surveyed the demarcation of palatine rugae preservation and used for an descriptive



Fig. 5: Cast with rugae pattern

tool in burn victims and cadavers, thus helping in solving forensic cases decomposed and incinerated bodies.

4.4. Forensic identification

Jumping into conclusion regarding person's identity can be a difficult task in various cases of plane crashes accidents, terrorist attacks or mass disaster situations. Allen et al. in 1889 suggested the application of palatal rugae markings for personal identification.

4.5. Preference of Palate over other lip prints or finger prints⁷

The markings of palatine rugae display racial and gender diversity as they are not subjected to obvious changes. Rugae are protected from trauma and other extreme conditions like high temperatures as they are shielded by the lips. Although in decomposed bodies lipprints and fingerprints cannot be recorded. But on the other hand palatal rugae are available for comparison and identification as they are least resistant to destruction.

4.6. Antemortem data can be advantageous⁷

As it is demanding to obtain dental arch impressions from corpses arriving at Forensic Medicine Institute so antemortem data of victim can be compared. As experts are not familiar with dental impressions so in such cases antemortem models can be obtained from victims' dentists and can be compared with postmortem images using software.

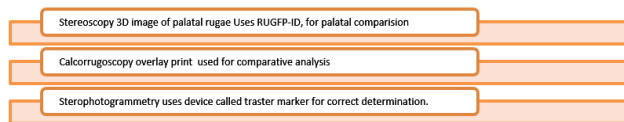


Fig. 6:

4.7. Digital ways for scrutinizing pattern of rugae⁷

4.8. Outcome of various literature for palatoscopy

1. **Byatnal A et al in 2014⁶** conducted a comparative study for analyzing variations among five different populations of India and upon concluding it could not identify any special variations in diffusion of various palatal rugae markings. Thus, further studies are required by taking huge study samples.
2. **Ramdas S et al in 2019⁵** conducted a study for comparing and correlating Dactyloscopy and Palatoscopy with blood group from western Maharashtra population. Thus to sum up the comparison made with palatal rugae and finger print yielded no result.
3. **Ashoka A et al in 2020⁸** carried out a study on 200 individuals (100 males and 100 females) among Kerala population. Thus on winding up study has proved cheiloscopy and palatoscopy identified the sex and identity of the individual.
4. **Sharma P et al in 2009⁹** conducted a study for forensic recognition, using method of cheiloscopy and palatoscopy. On summing up it shows that not palatal rugae and lip prints are unique to an individual, but lip prints are more loyal for identification of the gender.
5. **Asdullah M et al in 2014¹⁰** studied the widespread presence of different palatal rugae markings in an instance of Lucknow. On concluding it was found that there is a scope that exists to determine sex of an individual as well as personal identification.
6. **Rajguru J P et al in 2014¹¹** analyzed the rugae markings in dentulous and edentulous dentition and also evaluated the association of rugae markings between genders. To sum up in the present study there is similar distribution of rugae pattern between male and female dentition while there is varied pattern between the sexes of edentulous population.
7. **Pramanik A et al in 2019¹²** conducted a study to check any gender difference in palatal markings pattern among subjects from Bengal in Murshidabad district. Thus, current study revealed a significant gender difference in palatal rugae markings in Murshidabad population.
8. **Mathew SA et al in 2016¹³** conducted a study to compare the uniqueness of rugae marking and cheiloscopy and on conclusion it was found that the

sex and identity of the individual, as they remain stable over time and unique to individual.

9. **Satish K et al in 2012**¹⁴ conducted a study among regarding palatal rugoscopy among Puducherry population and found that wavy pattern was most prominent followed by curved, straight, branched and circular pattern in both the genders.

5. Conclusion

Palatal rugae are located in the frontal half of the mouth, serves as landmark in various studies . Various studies show a huge significance between rugae forms and different ethnicity. Palatal rugae are important in forensic investigations. Antemortem records can be kept so it is responsibility of government to maintain these records for future.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

- Bhullar A, Kaur RP, Kamat MS. Palatal Rugea – an Aid in Clinical Dentistry. *J Forensic Res.* 2011;2(3):124. doi:10.4172/2157-7145.1000124.
- Kesri R, Das G, Tote J, Thakur P. Rugoscopy- Science of Palatal Rugae: A Review. *Int J Dent Med Res.* 2014;1(4):103–7.
- Mahajan R, Dar MA, Risam SS. "Palatoscopy / rugoscopy: a potential tool in human identification." . *J Evol Med Dent Sci.* 2014;3(4):10076–88. doi:10.14260/jemds/2014/3307.
- Krishnappa S, Srinath S, Bhardwaj P, Mallaya CH. Palatal Rugoscopy: Implementation in Forensic Odontology- A Review. *J Adv Med Dent Sci.* 2013;1(2):53–9.
- Bommanavar S, Ramdas S, Baad R, Vibhute N, Belgaumi U, Kadashetti V, et al. Correlation and comparison of dactyloscopy and palatoscopy with blood groups among dental students from Western Maharashtra. *Med J Dr DY Patil Vidyapeeth.* 2019;12(2):111–5. doi:10.4103/mjdrdypu.mjdrdypu_65_18.
- Guruprasad Y, Telagi N, Byatnal A, Byatnal A, Kiran A, Samata Y. Palatoscopy: An adjunct to forensic odontology: A comparative study among five different populations of India. *J Nat Sci Biol Med.* 2014;5(1):52–5. doi:10.4103/0976-9668.127287.
- Monga DK, Bhateja S, Arora G. Palatoscopy: A way to discover victim's identity in mass disaster. *J Oral Med Oral Surg Oral Pathol Oral Radiol.* 2020;5(4):121–3. doi:10.18231/j.jooo.2019.029.
- Ashok A, Thomas N. Comparative reliability of cheiloscopy and palatoscopy in human identification and sex determination: Among Kerala population. *Int J Forensic.* 2020;5:11–9.
- Sharma P, Saxena S, Rathod V. Comparative reliability of cheiloscopy and palatoscopy in human identification. *Indian J Dent Res.* 2009;20:453–60.
- Asdullah M, Kandakurti S, Sachdev A, Saxena V, Pamula R, Gupta J. Prevalence of different palatal rugae patterns in a sample Lucknow population. *J Indian Acad Oral Med Radiol.* 2014;26(4):405–9. doi:10.4103/0972-1363.155687.
- Rajguru JP, Misra SR, Somayaji NS, Masthan KMK, Babu AN, Mohanty N. A Comparative Rugoscopic Study of the Dentate and Edentulous Individuals in the South Indian Population. *Sci World J.* 2014;2014:1–4. doi:10.1155/2014/283428.
- Pramanika DM, Debnath M. A Comparative Study of Gender Difference in Palatal Rugae Patterns among Bengali Subjects in Murshidabad. *Int J Anat.* 2019;8(1):6–10.
- Mathew SA, Kasim K, Mrudula KI, Jayashekeran. Establishing Identity Using Cheiloscopy and Palatoscopy. *Sch J Dent Sci.* 2016;3(3):74–80.
- Kumar S, Balaji N, Shanthi V, Sumathi M, Vendhan P. Palatal Rugoscopy Among Puducherry Population. *J Contem Dent Pract.* 2012;13(3):401–4. doi:10.5005/jp-journals-10024-1158.

Author biography

Avineet Kaur, Senior Lecturer

Shalika, Junior Resident

Harnoor Singh Sandhu, Emergency Medical Officer

Reshma Dodwad, Reader

Mehraab Kaur Dhillon, Student

Simmerpreet J Mann, Dentist

Cite this article: Kaur A, Shalika, Sandhu HS, Dodwad R, Dhillon MK, Mann SJ. Palatoscopy (Rugoscopy) assistance in forensic investigations. *IP Int J Forensic Med Toxicol Sci* 2021;6(2):31-35.