

REVIEW

Rugoscopy for Establishing Individuality

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ABSTRACT:

Palatal rugoscopy is the name given to the study of palatal rugae. Rugae pattern remain unchanged during an individuals life time. Personal identification is based on the rugae pattern since palate would remain intact when most other anatomical structures are destroyed or burned by their internal position in the head. Rugae pattern is as unique to a human as his or her fingerprints.

OBJECTIVES- The purpose of the study is to establish individual identity using palatal rugae Patterns.

MATERIALS AND METHODS - Study group consisted of 90 study models including both genders aged above 14yrs. Martin dos santos classification was followed to asses rugae pattern.

RESULTS- Each individual had different set of rugae patterns even among the family members. The rugae patterns were not symmetrical, both in number and in its distribution.

CONCLUSION- No two palates are alike. Palatal rugae possess unique characteristics as they are absolutely individual and therefore can be used as a personal print for identification and also in forensic science.

Key words: *Personal identity, Rugae pattern, Rugoscopy, Palatoscopy, Unique pattern..*

Introduction

Forensic identification by its nature is a multidisciplinary approach relying on positive identification methodology as well as presumptive or exclusionary methodologies which deals with proper handling and examination of dental finding.²

Personal identification forms an integral part of forensic science especially, when they are dealing with any crime or with mutilated bodies that have

undergone damage beyond recognition. Nature has made each and every individual different in his or her own way and personal identification is the proof.⁴

Palatoscopy or palatal rugoscopy, is the name given to the study of palatal rugae in order to establish a person's identity.²⁰

The use of palatal rugae was suggested as one of the method of identification in 1889 by Harrison Allen. Forensic odontology involves dentist's participation in assisting legal and criminal issues.⁴

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Palatal rugae are well protected from trauma by their internal position in the head and they are insulated from heat by the lips, tongue and the buccal fat pads.¹² Personal identification is based on the rugae pattern since the palate would remain intact when most other anatomical structures are destroyed, burned or dehydrated.¹² and also in situations where there are no fingers available. It is a well established fact that anatomical position of rugae that, it retains its shape throughout life²⁴ and resist decomposition.

Studies have demonstrated that no two palates are alike in their configuration and that the characteristic pattern of the palate does not change as a result of growth.³⁰ This unique feature led us to undertake a study to establish individual identity using palatal rugae pattern.

Objectives of the study:

- 1) To investigate the role of rugae pattern in personal identification.
- 2) To determine the uniqueness of palatal rugae pattern.
- 3) To identify any particular pattern of rugae among family members.
- 4) To assess the stability of the palatal rugae pattern in the pre and post orthodontic models.

Materials and Methods:

This study was conducted at the Department of Oral Medicine and Radiology, M. R. Ambedkar Dental College and Hospital, Bangalore. The study consisted of 90 healthy subjects aged 14 years and above. Randomly selected 25 males and 25 females: 5 families (Father, Mother, Child A, Child B) 20 pairs of models (pre and post) of subjects who have completed the orthodontic treatment (10 Males, 10 Females)

Exclusion criteria: Subjects below the age of 14 years, congenital anomalies/malformations, previous orthognathic surgery, allergic to impression material, bony and soft tissue protuberances, active lesions, deformity or scars and trauma of the palate.

Alginate impression of maxillary arch was done after obtaining informed consent. Rugae pattern was recorded by adding Addition silicone over impression material as it has high tear strength and better accuracy, optimum pressure was applied to make an impression of the upper dental arch for all the subjects and the impressions were then poured with Type 3 dental stone.

The palatal rugae patterns were highlighted by black lead pencil on the cast (photograph 1) and were then analyzed following the classification of Martins dos Santos which presented a practical classification based on rugae location (table 1). The classified types of rugae patterns were recorded and the results were observed and tabulated.

This classification indicates and characterizes the following:

Initial rugae; the most anterior one on the right side is represented by a capital letter; Several complementary rugae; the other right rugae are represented by numbers; One subinitial rugae; the most anterior one on the left side is represented by a capital letter; Several subcomplementary rugae; the other left rugae are represented by numbers.

RESULTS

All the 90 working casts showed different rugae patterns. Therefore uniqueness of palatal rugae pattern makes it a characteristic of an individual and thereby aids in personal identification.

In this study each individual had a different set of rugae pattern. However curve forms of rugae were more commonly seen [Graph- 1]

In this study Rugae among family members showed different individual patterns Figure - 2

To ascertain the permanence and stability of rugae patterns with time and force, it was observed that rugae pattern were found to be consistently stable even at the end of orthodontic treatment suggesting that the orthodontic force have no significant effect on the position and shape of palatal rugae pattern (Fig 3 Table2).

DISCUSSION

Palatoscopy or palatal rugoscopy, is the name given to the study of palatal rugae in order to establish a person's identity.¹⁰

In the hard palate, anteroposteriorly a thin central groove is bordered on each side by a crest, the palatal raphae. From this crest, laterally three to seven smaller crests emerge. These crests are called palatal rugae.¹⁰ Rugae develop as localized regions of epithelial proliferation and thickening.²⁰

The anatomical position of the rugae in the mouth remains unchanged in its position throughout life, withstands disease, chemical aggression and trauma. It is stable and resists decomposition for up to seven days after death.¹⁰

The use of palatal rugae in forensic identification is preferred because of their low utilization cost, simplicity and reliability, the study of maxillary dental cast is the most used technique. Thus, it is sufficiently characteristic to discriminate between individuals because no two palates are alike in their configuration. This finding is in congruity with results obtained in the similar studies conducted earlier.¹⁰

In our study we found that rugae pattern did not simply comprise of one form alone, but appeared as a mixture of varying forms. Curve forms were most commonly seen followed by line and sinuous forms.

"The fibers running anteroposteriorly within the core and in concentric curves across the base of each ruga" determine their orientation and forms.

The varying shapes of palatal rugae can be attributed to the fact that rugae develop as localized regions of epithelial proliferation and thickening.²⁰ Fibroblasts and collagen fibers then accumulate in the connective tissue beneath the thickened epithelium and assume distinct orientation.

In this study the palatal rugae pattern of all 90 subjects were distinct and unique. None of the patterns were identical and in each individual also no bilateral symmetry was observed. This finding is in congruity with results obtained in the similar studies conducted by English WR.^{12, 17, 19, 20, 23} This proves that palatal rugae pattern is unique to each individual.

We observed that curve form was most common which is in consistent with findings of previous study conducted by Nayak et al on Indian population. It can therefore be concluded that certain rugae shapes are specific to particular population and might have better utility in population differentiation.²⁰

In comparison of palatal rugae pattern among family members (Father, Mother, Child A and Child B) showed different individual patterns. Although in one of the family few forms were similar but the rugae pattern was not identical which suggests that the role of heredity is uncertain in determining the orientation of rugae pattern

To ascertain if palatal rugae can remain stable due to act of force with time, we recorded and analyzed the pre and post orthodontic casts of 10 males and 10 females, treatment duration ranging from eighteen to twenty four months. Pre orthodontic cast was used as an antemortem record and for superimposition. Post-orthodontic cast represented postmortem record.

On analyzing the post orthodontic casts, rugae patterns remained consistently stable and unaltered at the end of treatment which suggests that rugae pattern remain unchanged during an individual's lifetime and also following action of force.

This is in consistent with the study conducted by Sabet and Abdel.^{5, 10} The core within the palatal rugae of humans contains elements that are believed to contribute to the maintenance of its shape. The main structural element contains glycosaminoglycans which by its hydrophilic nature causes the tissues to swell and contributes to the maintenance of the shape of rugae through out life. Fibroblasts and collagen fibers beneath the thickened epithelium contribute to the stability of palatal rugae.

In light of these results, we strongly suggest that palatal rugae pattern can be used in forensic science and also for antemortem and postmortem identification.

However, we suggest that further studies should be conducted on a large number of individuals of different races, family members. Also a standard and uniform procedure needs to be put forth for the collection, recording and computerized analysis of the palatal rugae

CONCLUSION:

Human identification of unknown individual has always been of paramount importance to society. It is well established fact that the rugae pattern is as unique to a human as or her fingerprints. It is stable and resist decomposition for up to seven days after death.

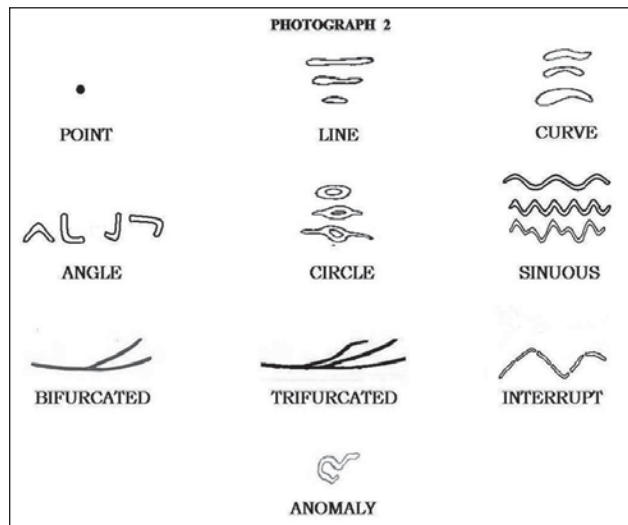
The use of palatal rugae in forensic identification is preferred because of their low utilization cost, simplicity and reliability. Thus, it is sufficiently characteristic to discriminate between individuals

because no two palates are alike in their configuration. Based on this premise, palatal rugae can emerge as one of the tools for personal identification in forensic science. In view of these significant findings that palatal rugae possess unique characteristics as they are absolutely individual, stable, permanent and unique. Therefore could be used as a personal print for identification and deserves further investigation with larger samples.

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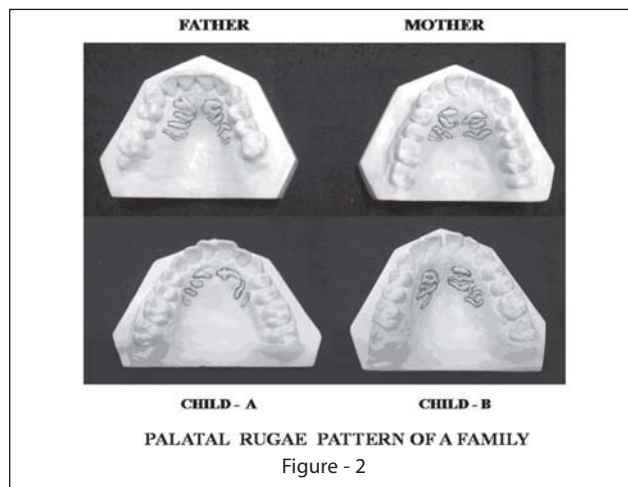
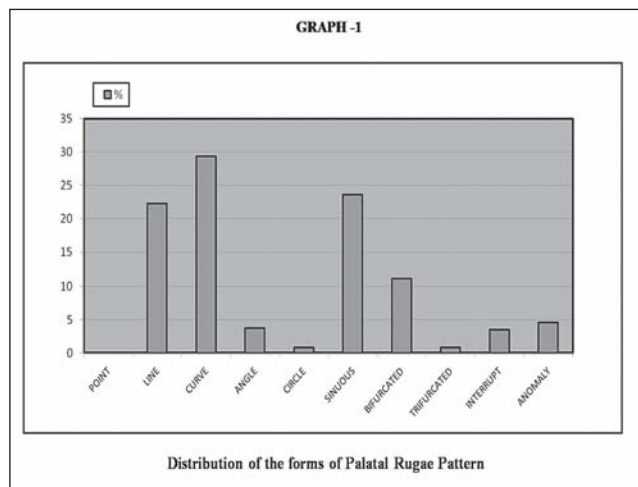
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Photograph 1: Highlighted palatal rugae pattern



MARTINS DOS SANTOS CLASSIFICATION OF PALATAL RUGAE (Table 1)

Rugae Type	Anterior Position	Other Positions
Point	P	0
Line	L	1
Curve	C	2
Angle	A	3
Circle	C	4
Sinuuous	S	5
Bifurcated	B	6
Trifurcated	T	7
Interrupt	I	8
Anomoly	An	9



PALATAL RUGAE PATTERN OF ORTHODONTICALLY TREATED SUBJECT



PRE



POST

TABLE 2: PALATAL RUGAE PATTERNS AMONG 10 MALES & FEMALES WHO HAD UNDERGONE ORTHODONTIC TREATMENT

SL. NO.	Ortho Model	Male		Female	
		RIGHT SIDE	LEFT SIDE	RIGHT SIDE	LEFT SIDE
1	PRE	C62	C155	C2251	B1531
	POST	C62	C155	C531	C55
2	PRE	L8853	C158	C621	L2155
	POST	L8853	C158	C621	L2155
3	PRE	B552	A151	C135	C222
	POST	B552	A151	C135	C222
4	PRE	B5215	C525	C1555	B2511
	POST	B5215	C525	C1555	B2511
5	PRE	B653	C655	C588	L555
	POST	B653	C655	C588	L555
6	PRE	C655	C256	C535	C515
	POST	C655	C256	C535	C515
7	PRE	C51	C565	L255	B1523
	POST	C51	C565	L255	B1523
8	PRE	L159	B219	C25	B15
	POST	L159	B219	C25	B15
9	PRE	B12	A655	L215	C112
	POST	B12	A655	L215	C112
10	PRE	C253	B51	C1558	C152
	POST	C253	B51	C1558	C152