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COMPARISON OF PALATAL RUGAE WITH DIRECT AND INDIRECT BLOOD GROUPING

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ABSTRACT

Introduction: Over several years palatal rugae patterns and ABO blood group system were proved beneficial in forensic science. The antigens present in the blood are also found in saliva from which blood groups can be determined. **Aim**: To study different palatal rugae patterns and compare it with distinct ABO blood groups by direct and indirect blood grouping methods. **Materials and Methods**: The study sample consisted of 50 males and 50 females students from S.N. Dental College, Kalaburgi aging 18- 25 years. Palatal rugae of all individuals was studied by alginate impressions. Blood groups and blood antigens in saliva were determined by slide agglutination and absorption inhibition methods respectively. Results were stastistically analysed by chi-square test. **Results:** Both males and females showed predominantly wavy rugae shape followed by straight, curved and circular and more number of rugae on the left side of the palate. In males all the blood groups have predominant wavy rugae shape except O +ve which has major straight rugae shape. In female group, wavy rugae shape was predominant in blood groups A, B, AB and AB-ve. Straight rugae shape was predominant in blood group O and O- ve Secretor status was 96% in females and 94% in males. Blood group AB disclosed 100% secretor status for both gender. **Conclusion**: In the present study we have found correlation between palatal rugae and blood groups in both males and females. Thus palatal rugae evaluation and its association with direct and indirect blood grouping were proved beneficial in forensic science.

KEYWORD: Palatal rugae, blood and palatal rugae, common palatal rugae.

INTRODUCTION

Forensic odontology is a growing segment of forensic medicine. Identification corresponds to a combination of different procedures to recognize a person or an object[1] Identification requires demonstrating that a person or one of his or her characteristics being examined is the same as observed in a previous situation.[2] Role of forensic pathologist/odontologist goes all together with the police investigators in identifying an individual in conditions like mass disasters and criminal investigation.[3]

The ABO blood group system was most commonly used for forensic serological examination of blood before the wide usage of DNA typing. However, ABO blood grouping is still a useful method in the initial stages of crime investigation.[4] Blood groups are detected by using specific antibodies to inherited antigens on red cell surface. Blood groups remains same throughout the life, which formed the basis of the use of blood group substance in medico legal examination.[5] Antigens present in the blood are also secreted into other body fluids such as saliva from which blood groups can be determined. Based on this, a person is said to be a secretor if he or she secrets their blood type antigens into their body fluids like the saliva, the mucus, where as, a non secretor does not secret or if so at all very little into body fluids.[6] Absorption inhibition method was developed in 1923 in Italy by vitorio sieacusa to detect blood group antigens in saliva.[7]

Palatal rugae or transverse palatine folds are asymmetrical and irregular elevations of the mucosa located in the anterior third of the palate, arranged in transverse direction from palatine raphae located in midsagittal plane.The palatal rugae was first described by winslow in 1753[8] and Allen in 1889[9] discussed their role as an identification method. Rugae are protected from trauma by their internal position in the

head, and they are insulated from heat by the tongue and the buccal fat pads.[10] palatal rugae are unique to an individual,once shaped, they do not go through any changes with the exception of length, due to regular growth. Diseases, chemical violence or trauma donot appear to change their form.[11] Comparing palatal rugae with blood groups may prove valuable in definite identification of an individual in forensic science.The present study was carried out to establish proportion of different palatal rugae patterns and compare it with distinct ABO blood groups of male and female population by direct and indirect blood grouping methods.

MATERIALS AND METHODS

Subjects

The study sample consisted of 100 students (50 males and 50 females) studying in S.N. Dental College, Kalaburgi, Karnataka, aging 18- 25 years. Ethical clearance and approval of all the students was obtained. Palatal rugae, blood groups and blood antigens in saliva were studied.

Recording the palatal rugae

Maxillary alginate impressions of all students were made, poured with dental stone and bases were prepared with dental plaster. A sharp graphite pencil was used to trace rugae patterns on these casts[fig.1]. The palatal rugae patterns were later studied on these casts in natural light.

Fig 1: Cast of the samples showing rugea pattern.

Palatal rugae were then examined using Thomas and Kotze classification(1983)[12] A.Based on shape.

1. Curved: Crescent shaped and curved gently.
2. Wavy: Slight curve at the origin or termination of curved rugae.
3. Straight:Ran directly from their origin to termination.
4. Circular: Formed from a definite continuous ring.

B. The direction of the rugae was determined by measuring the angle produced by the line joining its origin and termination and the line perpendicular to the median raphe.
1.Forwardly directed: Rugae associated with positive angles, 2.Backwardly directed: Rugae associated with negative angles.

C. Unification occurs when two rugae are joined at their origin or termination: 1.Diverging: Two rugae having the same origin, but immediately branched, 2.Converging:Rugae with different origins joined on their lateral portions.

Determination of blood groups and salivary blood antigens.

All individuals venous blood was drawn from cephalic vein of right arm and collected into EDTA vacutainers[fig2], centrifuged for 5 minutes to collect pure form of indicator erythrocytes. At the same time 4-5 ml of whole unstimulated saliva was also collected directly into the centrifuge tubes with screw caps of 15ml capacity by bending their heads. Blood groups for the collected blood were determined by slide agglutination method. Salivary blood antigen was estimated by by standard absorption inhibition method.

FiFig 2: EDTA vacutainers.

Procedure of slide agglutination method

Blood groups of all the individuals were determined by placing a drop of whole blood on each end of the slide, then each drop of blood is treated by one drop of anti-A and anti-B sera. Positive agglutination with anti-A is contemplated as blood group A,agglutination with anti-B is considered as blood group B,agglutination with none of the antisera is considered as blood group O and agglutination with both anti sera is deliberated as blood group AB. In the same way positive agglutination with Rh antigen is considered as Rh –positive or else as Rh-negative.

Procedure of absorption inhibition method

Centrifuge tubes with saliva were placed in boiling water bath for 10 minutes allowed to cool and then centrifuged for 10 minutes at 3000 rpm. Supernatant was discarded and clear saliva was collected using pipette. Four disposable test tubes of 5ml capacity were taken out of which 2 labeled as TEST and two labeled as CONTROL. One drop of diluted antisera (1:8) was added to each tube respectively. To every TEST tube, one drop of clear saliva and to each control tube one drop of saline were added, later mixed and finally incubated at room temperature for 10 minutes. Then one drop of indicator erythrocytes was added to each tube, mixed and incubated at room temperature for 10 minutes. Control tubes were centrifuged for 10 minutes, for saline reaction. All control samples showed clumping due to the absence of antigen. The test group was considered as positive if agglutination was not seen, indicating that antigen – antibody reaction had taken place between saliva and antisera, and there was no antibody left for RBCs to react, indicating the presence of blood group and vice versa was applied for negative test group samples.[13]

Statistical analysis

Chi-square test was used for statistical comparison between the groups. A P value <0.05 were considered to be significant. Data were analysed using software SPSS version16.0.

Table 1: Comparison of blood groups between male and female population.

Blood groups	Males(%)	Females(%)	Total	Z value	P value
A +VE	11(22)	13(26)	24	0.5	0.3198
B +VE	11(22)	12(24)	23	0.2	0.4061
AB +VE	11(22)	12(24)	23	0.2	0.4061
O +VE	10(20)	08(16)	18	0.5	0.3013
AB –VE	04(08)	03(06)	07	0.4	0.3476
O –VE	03(06)	02(04)	05	0.5	0.3232
CHI SQUARE VALUE	3.99(P VALUE=0.5510)				

Table 2: Comparison of palatal rugae between male and female population.

Palatal rugae	Males(%)	Females(%)	Chi square value	P value
SHAPE Curved Wavy Straight Circular	24(5.99) 200(49.88) 173(43.14) 4((0.99)	29(7.06) 216(52.55) 163(39.66) 3(0.73)	1.40	0.704
UNIFICATION Diverging Converging	36(70.59) 15(29.41)	36(62.07) 22(37.93)	0.878	0.349
DIRECTION Forwardly directed Backwardly directed Perpendicular	161(34.04) 187(39.53) 125(26.43)	166(36.41) 180(39.47) 110(24.12)	0.857	0.652
SIDE Right Left	191(50.93) 184(49.07)	207(53.91) 17746.09)	0.672	0.412

Table 3: Comparison of palatal rugae between blood groups for female population.

Palatal rugae	A(%)	B (%)	AB (%)	O(%)	AB – VE(%)	O – VE(%)	Chi square value	P value
SHAPE Curved Wavy Straight Circular	5(6.3) 38(47.4) 35(43.8) 2(2.5)	5(5.3) 55(58.5) 34(36.2) 0(0)	5(5.7) 50(57.5) 32(36.8) 0(0)	10(12.3) 30(37.0) 40(49.4) 1(1.3)	2(5) 30(75) 8(20) 0(0)	2(6.9) 13(44.8) 14(48.3) 0(0)	26.2	0.036
UNIFICATION Diverging Converging	10(90.9) 1(9.1)	9(81.8) 2(18.2)	8(80) 2(20)	4(28.6) 10(71.4)	4(44.4) 5(55.6)	1(33.3) 2(66.7)	16.0	0.007
DIRECTION Forwardly directed Backwardly directed Perpendicular	46(46.9) 31(31.6) 21(21.5)	28(28.9) 44(45.4) 25(25.7)	28(29.9) 49(50.5) 20(20.6)	37(43.5) 33(38.8) 15(17.7)	13(30.9) 17(40.5) 12(28.6)	14(43.8) 6(27.2) 2(9.0)	21.3	0.019
SIDE Right Left	34(49.2) 35(50.8)	54((60.7) 35(39.3)	61(64.2) 34(35.8)	31(40.8) 45(59.2)	18(51.4) 17(48.6)	9(40.9) 13(59.1)	12.2	0.032

Table 4: Comparison of palatal rugae between blood groups for male population.

Palatal rugae	A+VE	B +VE	AB +VE	O +VE	AB -VE	O –VE	Chi square value	P value
SHAPE Curved Wavy Straight Circular	8(7.3) 56(50.9) 45(40.9) 1(0.9)	4(4.3) 44(47.8) 44(47.8) 0(0)	5(4.8) 60(57.7) 38(36.5) 1(0.9)	3(5.8) 21(40.4) 28(53.8) 0(0)	2(10) 11(55) 6(30) 1(5)	2(15.4) 8(61.5) 2(15.4) 1(7.7)	28.7	0.018
UNIFICATION Diverging converging	11(73.3) 4(26.7)	2(100) 0(0)	13(76.5) 4(23.5)	8(88.9) 1(11.1)	0(0) 5(100)	2(66.7) 1(33.3)	14.6	0.012
DIRECTION Forward Backward Perpendicular	50(38.8) 43(33.3) 36(27.9)	33(31.1) 49(46.2) 24(22.6)	40(34.5) 43(37.1) 33(28.4)	31(40.8) 26(34.2) 19(25)	0(0) 18(75) 6(25)	7(31.8) 8(36.4) 7(31.8)	22.4	0.013
SIDE Right Left	54(45) 66(55)	37(42.5) 50(57.5)	56(63.6) 32(36.4)	29(64.4) 16(35.6)	6(37.5) 10(62.5)	9(47.4) 10(52.6)	14.4	0.013

Table 5: Percentage of secretor and non secretor in males, females and total.

BLOOD GROUPS	MALES		FEMALES		TOTAL	
	SECRETOR	NON SECRETOR	SECRETOR	NON SECRETOR	SECRETOR	NON SECRETOR
A+VE(%)	10(90.9)	1(9.1)	13(100)	0(0)	23(95.8)	1(4.2)
B+VE(%)	10(90.9)	1(9.1)	11(91.7)	1(8.3)	21(91.3)	2(8.7)
AB+VE(%)	11(100)	0(0)	12(100)	0(0)	23(100)	0(0)
O+VE(%)	9(90.0)	1(10.0)	8(100)	0(0)	17(94.4)	1(5.6)
AB –VE(%)	4(100)	0(0)	2(66.7)	1(33.3)	6(85.7)	1(14.3)
O –VE(%)	3(100)	0(0)	2(100)	0(0)	5(100)	0(0)

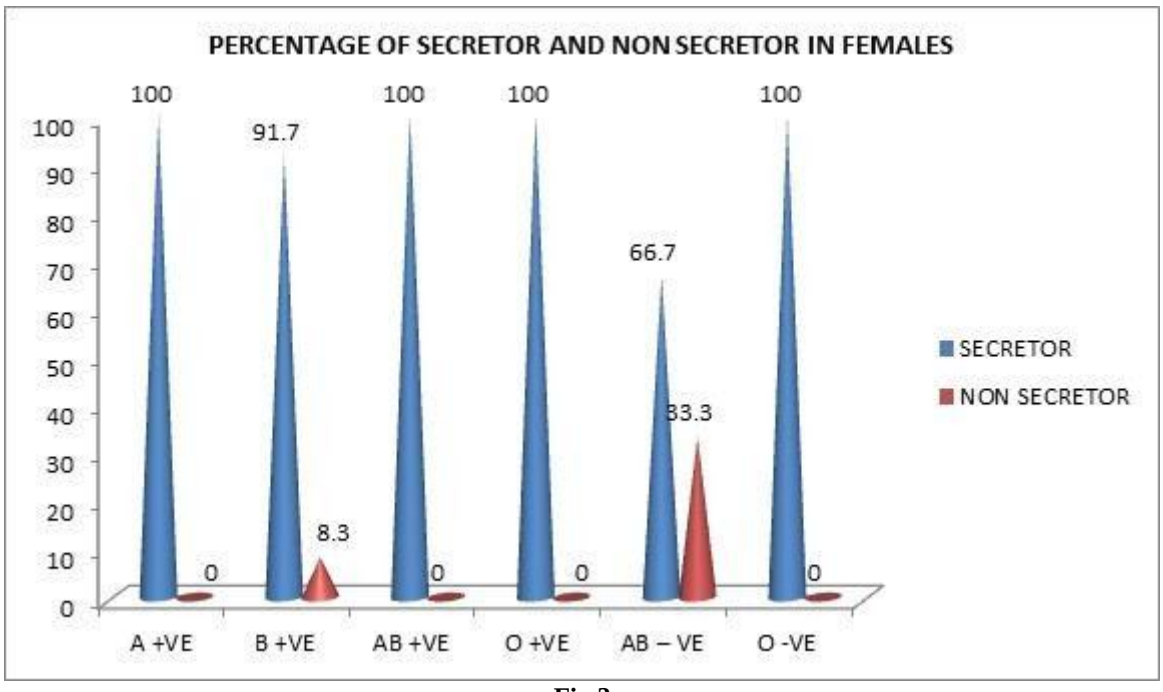

Fig 3

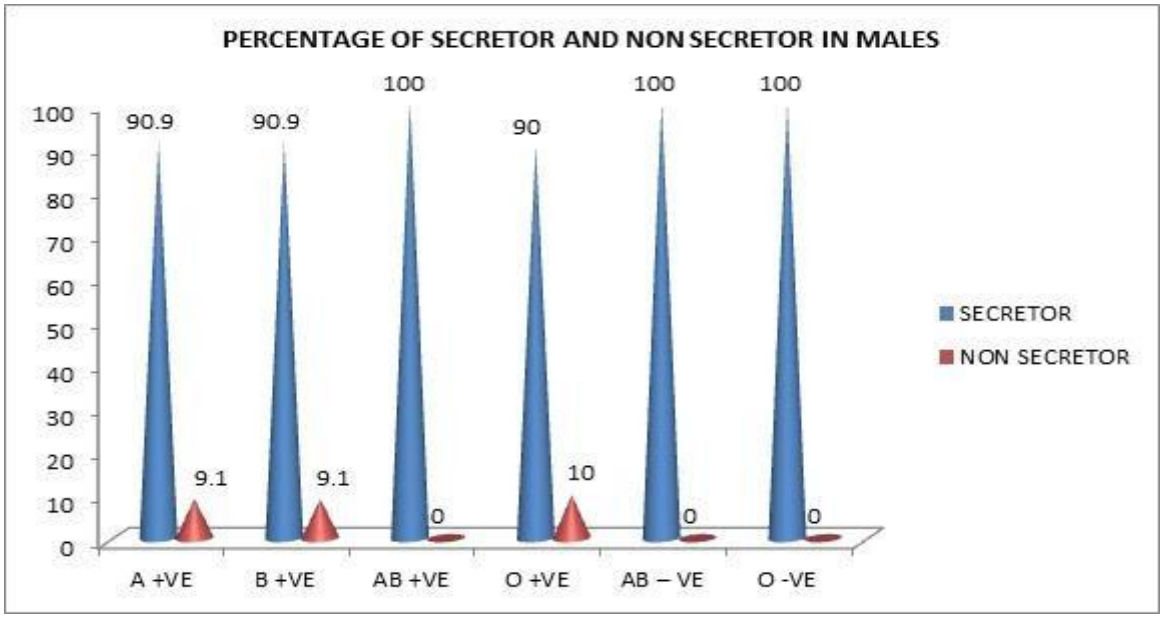

Fig 4.

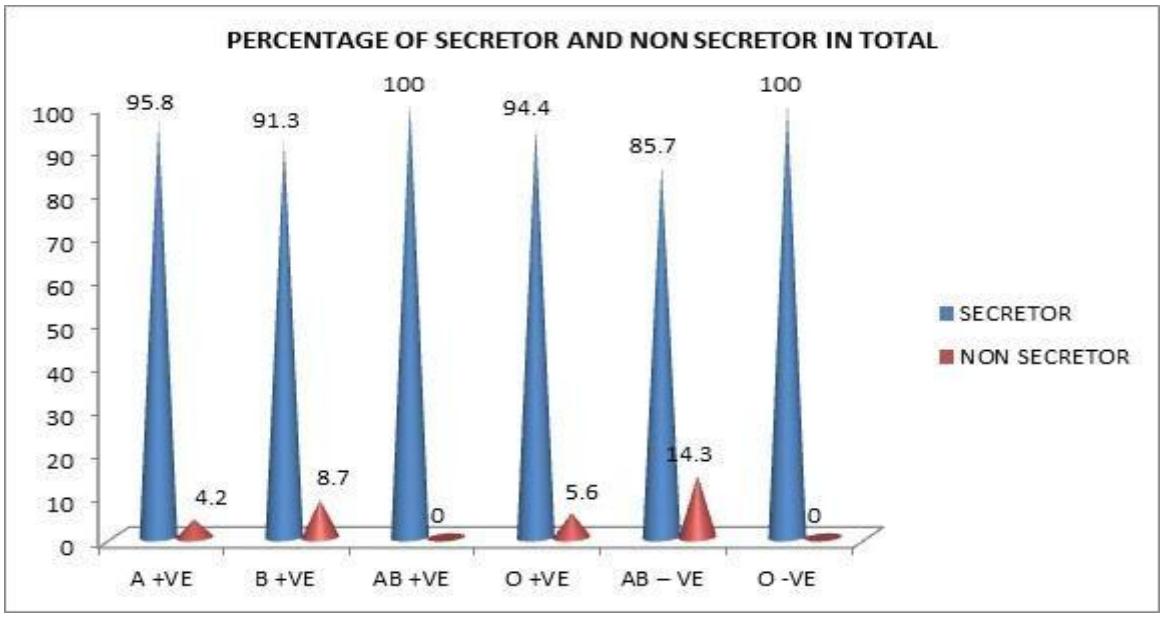

Fig 5.

RESULTS

Palatal rugae

The predominant rugae shape in both male and female population is wavy followed by straight, curved and circular in descending order. The major rugae unification in both the population is diverging. Backwardly directed rugae were the most common type in both the population followed by forwardly directed rugae and perpendicular rugae. Both male and female population showed relatively more number of rugae on the left side of the palate. Statistical comparison of palatal rugae between male and female population is not significant.

Blood groups and Rh system

Majority of the males (22%) belonged to blood Group A, B and AB, followed by blood Group O (20%), AB -ve(8%) and O-ve (6%). Whereas blood Group A (26%) was higher in females followed by blood Group B and AB (24%), A (10%) , O (16%), AB-ve(06%)and O-ve(04%). 86% of males had the Rh-positive factor, and only 14% of males had Rh-negative factor. In females, 95% were Rh-positive and only 5% were Rh –negative. Statistical comparison of blood groups between male and female population is not significant.

Comparison of palatal rugae with blood groups

In male group: All the blood groups have predominant wavy rugae shape except O +ve which has major straight rugae shape. Blood groups A, B and AB, AB-ve and O-ve have predominant backwardly directed rugae. Blood group O have major forwardly directed rugae. The predominant rugae unification is diverging type in A,B,AB,AB-ve, and O-ve blood groups. While blood group O have predominant

converging type of rugae unification.

In female group: Wavy rugae shape was predominant in blood groups A, B, AB and AB-ve. Straight rugae shape was predominant in blood group O and O-ve.. Blood groups B, AB and AB-ve have predominant backwardly directed rugae. Blood groups A,O and O-ve have predominant forwardly directed rugae. The major rugae unification in blood groups A, B and AB is diverging type. While blood groups O, O-ve and AB-ve have converging type of rugae unification.

Statistical significant difference is found between palatal rugae and blood groups in both males and females.

Comparison of blood groups with salivary blood antigens

A slightly higher percentage secretor status was found in females(96%)[FIG3] than in males(94%)[FIG4]. Blood group AB disclosed 100% secretor status for both males n females. While blood group B revealed 90.9% and 91.7% secretor status for males n females respectively. Blood group A revealed 90.9% and 100% secretor status for males and females respectively. Bloodgroups O revealed 90% and 100% secretor status in males and females respectively. Blood group. AB-ve revealed 100% and 66.7% secretor status for males and females respectively. Blood group O-ve revealed 100% secretor status for both males and females[FIG5].

DISCUSSION

Anthropometry, fingerprints, dental records, gender determination, age estimation, weighing, identifying by specific characteristics and blood group differentiation are the traditional methods for human identification.[14]

Over several years palatal rugae, blood groups and slivary blood antigens have proved beneficial in forensic identification as palatal rugae are unique for each individual, blood groups are not changed once developed and blood antigens are also secreted into saliva from which blood groups can be determined. Till date studies have not been conducted to compare palatal rugae with blood groups between male and female population separately. In the present study we have tried to correlate palatal rugae with blood groups and salivary blood antigens in male and female population by direct and indirect blood grouping methods.

In our study the predominant rugae shape in both male and female population is wavy, which was similar to results obtained by Abdellatif AM et al.(2011);[16] Nayak P et al. (2007);[17] Kotrashetti et al. (2007);[18] and Satish KN et al.(2012).[19] The present study shows predominantly wavy rugae followed by straight, curved and circular, similar to findings of the study conducted by Dr. Inderpreet Singh Oberoi et al.(2017).[20]

The major rugae unification in the present study in both the population is diverging which was similar to results of Rani S Thabitha et al.(2015);[21] In contrast, Fahmi FM et al.(2001):[22] found that converging rugae is more in Saudi females than males.

Backwardly directed rugae were the most common type in both the population followed by forwardly directed rugae and perpendicular rugae. However backwardly directed rugae pattern was predominant in males and forwardly directed rugae is the major rugae type in females as per the study done by Neha Dwivedi and Anil kumar Nagarajappa.[25]

Both male and female population showed relatively more number of rugae on the left side of the palate. This finding was similar to paliwal A et al.(2010).[23] and Santosh Hunasgi et al.(2014).[24] This may be attributed to regressive evolution dominating the right side of the palate.[23]

Statistical comparison of palatal rugae between male and female population is not significant In male group: all the blood groups have predominant wavy rugae shape. Blood groups A,B and AB have predominant backwardly directed rugae. Blood group O have major forwardly directed rugae.

In female group: wavy rugae shape was predominant in blood groups AB and B. Straight rugae shape was predominant in blood group O. Blood groups A, AB and O have predominant backwardly directed rugae. Blood group B have predominant forwardly directed rugae.

Statistical significant difference is found between palatal rugae and blood groups in both male and female population.

Finding of 95% secretor status in our study is higher than the studies conducted by Motghare P et al.(2011);[26] and Kaur G et al.(1988).[27] A slightly higher percentage secretor status was found in females(96%) than in males(94%) and blood group AB revealed higher secretor status followed by blood groups A, O and B in the study, which was similar to results obtained by Motghare P et al.(2011).[26]

Palatal rugae can prove beneficial in identification especially in edentulous patients where dental identification is not possible.[28]

When salivary secretions are found at crime scene, the blood substances in secretions and tissues are more complex to identify as compared to blood itself. Samples in smaller amount further limit the reliability of the tests.However it may prove helpful in corresponding findings from blood samples and in the absence of blood.[15] Dried up salivary stains can be confirmed by positive amylase activity.[26]

CONCLUSION

In the present study we have found correlation between

palatal rugae and blood groups in both males and females and we have also acquired 96% and 94% secretor status for blood groups in female and male group respectively. Thus palatal rugae evaluation and its association with direct and indirect blood grouping were proved beneficial in forensic science in conditions like mass disasters and criminal investigation.

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