ORIGINAL ARTICLE

ANALYSIS OF PALATAL RUGAE PATTERN IN POPULATION OF ABBOTTABAD: A FORENSIC STUDY

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Background: Identification of unknown dead bodies' especially bony remains is done by different methods like DNA typing, Finger printing, Dental and other skeletal data, facial reconstruction and rugae pattern study. Palatal rugae pattern study or Ruguscopy gives a unique method of identification in cases of skeletal remains due to its uniqueness, resistance to heat, and stability throughout life. **Methods:** This simple random sampling was carried out on 102 study models (casts of palate) of patients having 880 rugae patterns above 20 years of age in Khan Dental Clinic near Ayub Medical College, Abbottabad. The study is based on classification given by Thomas *et al*. Casts were taken from palate and then individual casts studied for rugae pattern. They were classified and variations studied for uniqueness **Results**: Each individual had different set of palatal rugae which are not same, in all its dimensions like size shape number etc. **Conclusion:** With the help of this study we can conclude that Palatal rugae pattern give unique method for individual identification.

Keywords: Plica palatine; Palate; Skeletal remains; Palatoscopy; Dental

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INTRODUCTION

The study of palatal rugae is known as ruguscopy that helps in establishing the individuality of a person.[1,2] Palatal rugae are present on each side of median palatal raphae, on the anterior side of palate, and just in front of incisive papillae.[3,4] Trobo Hermosa, the Spanish investigator 1st proposed the term Palatal rugoscopy".[5]

Rugae on plate due to their uniqueness, durability and variation can easily be classified. This classification due to variations are individual specific. During life time visits these casts can be recorded in the dental clinic containing the rugae pattern just like other dental data in the individual profile recorded in clinic/hospitals. In case of any unfortunate disaster when body is disintegrated especially in case of aeroplane crashes, bomb blasts etc where body is disintegrated palate usually escape injury and hence can be studied.

Palatal rugae were 1st described by Winslow in 1753. Carrea classified the rugae into fundamental and specific.[1] Allen in 1889 was the first one to give plica palatine pattern for establishing identity of individual.[6] Their patterns are not in symmetry and regularity. These are elevations that are formed in the intrauterine life around 3rd month from the maxillary bone. Epithelial and mesenchymal interactions control the growth and development of rugae. Along mid-Sagittal plane incisal papilla are present which forms rugae from their lateral membrane in transverse direction. Their stability for long durations help in medicolegal identification process.[7] Plica palatine are uniquely individual specific and remains same throughout life. Their resistance to trauma and burns especially when other methods are not helpful especially due to their position in oral cavity where it is surrounding by structures like cheeks, fat, lips and tongue etc. giving them protection. Study of rugae pattern is also a comparative method of identification. Especially in the cases of disasters we can check the hospital record of the population for identification because each individual from the population whenever visited dental clinic in his lifetime, his record can be preserved and can be used for future reference. Even Twins have not shown identical records.[8] This information gathering is very important for identification of individual, for establishing civil rights of next of KIN especially in present day scenario when bomb blasts, aero plane crashes and other violent events are in prevail especially when external parts for identification are not available.

MATERIAL AND METHODS

The study was conducted on 102 patients of age above 20 years randomly from Jan to May 2017. Patients were informed about the study and written consent was taken. All the participants were of Abbottabad origin visiting Khan Dental Clinic, Mandian Abbottabad including both males and females. Simple Random sampling was taken.

Participants with palatal abnormalities such as cleft palate, soft tissue protuberances, trauma of palate, and patients with braces, were excluded from the study. Mouth mirror, illuminating light, impression trays, alginate material, 0.5 mm black graphite pencil, metallic scale, metallic wire, vernier calliper were used to measure the individual palates.

Preliminary inspection was done using artificial light and instruments under sterile conditions. Impression of maxilla taken from each subject using impression material. Casts were formed after washing impressions in water. Black graphite pencil was used to locate and mark the patterns on the cast and then studied through naked eye. Measurements taken with the help of metallic wire and then their dimensions compared with the help of metallic scale and vernier calliper.

We classified the plica palatine according to study of Thomas *et al*[9] including different dimensions like, length, shape, number and pattern of rugae.

Lengthwise distribution of rugae pattern is classified into following three classes, i.e.,[9] Primary rugae, Secondary and Fragmentary rugae ranging in length from 5–10 mm, 3–5 mm and less than 2 mm respectively. On the basis of shape following four major types of rugae pattern were identified as straight, curved, circular and wavy in shape.[5,10]

This classification shows variations which are individual specific and vary from one individual to other individual throughout life. Platal Rugae further shows unification that is further classified into diverging and converging types.[11,12] When two rugae begin from the same origin but diverge transversely they form diverging pattern of rugae.[13] When two rugae arise from different regions and converge transversely they form Converging pattern.[11,12]

RESULTS

Eight hundred & eighty palatal rugae were identified in 102 subjects (including 52 (51%) male and 50 (49%) female), divided on both side of the median palatine raphe. Primary rugae are most dominant 749 (85%) followed by secondary 82 (9%) and fragmentary 49 (6%) with almost equal on both right and left side of median palatine raphe. (Table 5)

Primary rugae 464 (62%) and secondary rugae 50 (61%) are more in males as compared to 285 (38%) & 32 (39%) respectively in females. Fragmentary rugae are more common in females 37 (75%) than in males 12 (25%). (Table 6)

Regarding the shape among primary rugae are 546 (73%) are Curved in shape with 284 (52%) in males compared to 262 (48%) in females, followed by circular in shape 22 (3%) with 18 (81%) in males and 4% in females, wavy were 21 (3%) with males containing 17 (58%), females 4 (42%), and straight 157 (21%) of total primary with more common in males 09 (58%) than in females 66 (42%). (Table 1)

Secondary rugae are curved 61(74%) in males 42 (69%) and in females 19 (31%), followed by wavy 04 (5%) with equal number in both genders and straight rugae total number 17 (21%) males 11 (63%) and females 06 (37%) with significantly low or absent rugae circular in shape. The ratio is again more in males as compared to females. (Table 2)

Fragmentary rugae are straighter in shape29 (60%) with males having 7 (24%) and females 22 (76%), followed by curved 5 (11%) with males having 3 (67%) and females 2 (33%) and circular 9 (18%) males having 4 (40%) and females 5 (60%) followed by wavy 5 (11%) males 3 (67%) and females 2 (33%). (Table 3)

Primary rugae proportion regarding unification and diversion is almost equal primary rugae with 112 showing convergence and 110 rugae showing diversion. Secondary and fragmentary rugae did not show any feature of conversion or diversion. (Table 4)

Table-1: Shape wise distribution of primary rugae (n =746)

Gender	Curved shape 546 (73%)	Circular shape 22 (3%)	Wavy shape 21 (3%)	Straight shape 157 (21%)
Male	284 (52%)	18 (81%)	17 (58%)	91 (58%)
Female	262 (48%)	4 (19%)	4 (42%)	66 (42%)
Total	546	22	21	157

Table-2: Shape wise distribution of secondary rugae (n=82)

Gender	Curved shape 61 (74%)	Circular shape 0 (0%)	Wavy shape 4 (5%)	Straight shape 17 (21%)
Male	42 (69%)	0 (0%)	2 (50%)	11 (63%)
Female	19 (31%)	0 (0%)	2 (50%)	6 (37%)
Total	61	0	4	17

Table-3: Shape wise distribution of fragmentary rugae (n=49)

Gender	Curved shape 5 (11%)	Circular shape 9 (18%)	Wavy shape 5 (11%)	Straight shape 29 (60%)
Male	3 (67%)	4 (40%)	3 (67%)	7 (24%)
Female	2 (33%)	5 (60%)	2 (33%)	22 (76%)
Total	5	9	5	29

Table-4: Unification and diversion of rugae pattern

Type	Unification		Diversion	
	Right Side	Left Side	Right Side	Left Side
Primary	28	84	60	50
Secondary	0	0	0	0
Fragmentally	0	0	0	0

Table-5: Gender wise distribution of palatine rugue on both sides of palatine raphe (n=880

	Primary	Secondary	Fragmentary
Right Side	345 (46%)	40 (49%)	33 (68%)
Left Side	404 (54%)	42 (51%)	16 (32%)
Total	749 (85%)	82 (09%)	49 (06%)

Table-6: Gender wise distribution of rugae

	Primary	Secondary	Fragmentary
Male	464 (62%)	50 (61%)	12 (25%)
Female	285 (38%)	32 (39%)	37 (75%)
Total	749	82	49

DISCUSSION

Palatal Rugae pattern identification has gained importance in identification of individuals in mass disasters and other difficult conditions. They are unique in individuals not only in form but also in number and other dimensions. Palatoscopy is very useful in identification of decomposed or burnt bodies when fingerprint data are missing. Palatoscopy is a valuable using pilot's life data to know the individuality in aero plane accidents.

In our study, males had more number of rugae when compared to females. This result was in agreement with a study conducted by Indira *et al*.[14] where number of rugae were slightly higher in males. Bing *et al*.[15] also found in his study that the number of rugae were higher in males. Palatinas *et al*.[16] and Bing *et al*.[14] also found higher number of rugae in males; whereas Verma *et al*.[17] and Manjunath *et al*.[18] found that there were more rugae in females.

Regarding shape primary rugae are wavier in shape, study results consistent with Manjunath *et al*.[18] while Ohtani *et al*.[19] Indira *et al*.[20] Sharma *et al*.[21] in their studies show curved pattern higher.

Primary rugae proportion regarding unification and diversion is almost equal with no significant difference in both sex. This Study is consistent with the finding of Manjunath *et al*.[18], Sharma *et al*.[21] Azab *et al*.[22] and Rajan *et al*.[23] did not identified any significant difference for unification between different genders.

CONCLUSION

From the above study it is evident that palatoscopy is the additional way of identification especially helpful where other comparative methods of identification are not helpful due to limitations. It is alternate comparative method of identification due to its variations in size, shape, direction and gender, raising its significance especially in cases of mass disasters, aeroplane crashes, bomb blasts, burned bodies etc.

Dental clinics should record and keep the casts of palate along with other relative dental data during life time visits of population just like the record maintained in other advanced countries etc. so that comparison can be made with this data if any mass disaster happens and available source is only skull of individuals.

AUTHORS' CONTRIBUTION

OKJ: Basic concept, study design, Data collection, write-up. MUZ: Proof reading. FUZ: Write-up. DK: Study design. UF: Proof reading. IFT: Data collection. NS: Data collection

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