



COMPARISON OF PALATAL RUGAE PATTERN IN INDIAN & TIBETAN POPULATION

Forensic Medicine

Dr Akshay Sujith*	Department of Oral Medicine and Radiology H.P GDC Shimla 171001 *Corresponding Author
Dr Guruprasad R	Professor And Head Department of Oral Medicine & Radiology H.P GDC Shimla Himachal Pradesh -171001
Dr Neeta Sharma	Professor, Department of Oral Medicine & Radiology H.P GDC Shimla Himachal Pradesh -171001
Dr Shruti Singh Pathania	Assistant Professor Department of Oral Medicine & Radiology H.P GDC Shimla Himachal Pradesh -171001

ABSTRACT

: Introduction :Palatoscopy is the study of palatal rugae pattern to establish the identity of a person. It aids in establishing person identification, and also shows similarities in ethnic communities. Aim: The aim of our study was to compare the palatal rugae pattern in Tibetan and Indian population and to assess the ability to discern the ethnicity based on uniqueness of rugae pattern in two different ethnic groups. Background: Maxillary impressions were fabricated and the rugae pattern was compared on the basis of classification given by Thomas, Kotze & Kapali et al. Result: The most prevalent pattern was wavy in both Indian males and females with prevalence of 45.13% and 40.49% respectively. Curved pattern was seen more commonly in Tibetan females (28.76%) and wavy (20.96%) in Tibetan males. However divergent pattern (32.93%) was seen most commonly in Tibetan population. The study indicates that there is difference in the palatal rugae configuration between Tibetan and Indian population and it also aids in gender determination as observed in the study.

KEYWORDS

Forensic Identification, Indian Population, Palatal Rugae, Tibetan Population

INTRODUCTION

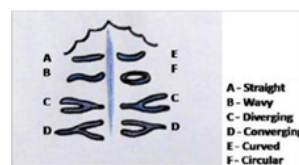
Human body identification is considered as a subfield in forensic science by using visual identification, facial recognition system, fingerprints and also from traces of DNA obtained from blood, semen, hair, saliva and semen. Identification of person using dental records is gaining popularity in recent years. Apart from various individual factors in oral cavity like the morphology of teeth and dental DNA, palatal rugae also forms a unique pattern from person to person and as per the studies it shows some similarity among different ethnic communities. These patterns are used in medico legal cases since their individual morphologic characters are stable over time.²

The palatal rugae are transverse ridges situated on the anterior part of palatine mucosa which are widely seen in mammals. In humans it is asymmetric bilaterally and consistent throughout the life.³

The physiological function of palatal rugae is to enhance the relation between food and taste receptors on the dorsal surface of tongue, it also helps in speech and sucking mechanism in children⁴. The anatomic location of the rugae in the oral cavity surrounded by cheek, lips, tongue and buccal pad of fat gives protection in case of trauma or heat. Hence when there is no other evidence present, like in a completely burned or destroyed body, palatal rugae pattern can act as a source for identification if post mortem and ante mortem records are present⁵⁻⁶. It can also aid in diagnosis and treatment planning in orthodontic treatment.⁷ It also plays a significant role in necro identification like in cases of aeronautical accidents majorly to identify the pilots if antemortem data present.⁸ In addition rugae pattern can give conclusive evidence in mass disasters if a forensic database record is already present⁹. Thomas and van Wyk¹⁰ described the identification of a badly burned body that was found with a set of dentures nearby. These dentures were compared to a set of dentures found in the suspected victim's house.

According to Thomas, Kotze & Kapali et al.³ the shape of individual rugae are classified (fig 1) into four major types:

1. Straight – Runs directly from origin to termination
2. Curvy – Simple crescent shape that was curved gently
3. Circular – Definite, continuous ring formation, diameter from origin to termination is considered
4. Wavy – Serpentine form.



Classification Fig 1 [15]

The forms which did not match the above mentioned shapes were classified into non-specific pattern, further a unification pattern is also included in the classification which is divided into converging and diverging configuration.

The purpose of our investigation was to assess & compare the palatal rugae in two different ethnic groups which may assist in differentiating population. In this study we are analysing & comparing the palatal rugae pattern among the Indian (Himachali Population) & Tibetan population.

Materials & Method

The study sample consisted of a total of 100 subjects above 18 years old with 50 Indian Himachali population (25 males and 25 females) residing in Shimla Himachal for the past two generations and 50 Tibetan subjects (25 males, 25 females) whose ancestral origin are from the Tibet, residing at the Tibetan settlement, Sanjuli Town, Shimla for the past few years. The study was explained to the subjects and informed consents were taken, maxillary alginate impressions (DPI Algitec The Burmah trading corp) were taken and the casts were replicated using type III dental stone (Kallstone, Kalabhai 3kg). The rugae pattern were highlighted using sharp & pointed lead pencil (Apsara Extra dark lead pencil) and with the help of magnifying lens (10X), the highlighted rugae pattern was analysed on the basis of classification given by Thomas, Kotze & Kapali et al (Fig 2 and 3). Subjects with history of cleft lip and palate, surgery of palate were not included in our study. The study was conducted after obtaining the clearance from the ethical committee.



Fig 2 Indian cast



Fig 3 Indian cast

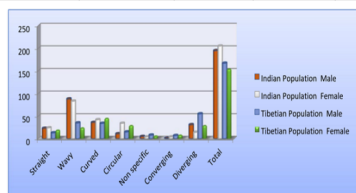
RESULTS

The results were analysed using descriptive statistics and the mean were compared using one sample t-test with $P < 0.5$ considered as statistically significant. In our study we observed a predominance of wavy pattern in both Indian males and females with a prevalence of 45.13% and 40.49% respectively where as in Tibetan Males there was a predominant unification pattern with diverging configuration and showed a prevalence of 32.93%. However curved pattern was more commonly seen in Tibetan females with prevalence of 28.76 %. Hence there was a prevalence of a particular rugae pattern among both the ethnic group included in our study (table 1).

It was also observed that in both Indian and Tibetan population males had more rugae present on the right side and females had more rugae on left side of the palate (table 2 graph 1) . More number of rugae were observed in the Indian population as compared to the Tibetan population. On analyzing with one sample T test significant result was found for wavy pattern in Indian population with p value of (0.0001) and diverging pattern in Tibetan population with a significant correlation of (p value= 0.006) . All other pattern does not showed any significant correlation among the population (table3).

Table 1

Palatal rugae shapes	Indian Population (50)			Tibetan Population (50)		
	Male (25)	Female (25)	Total (50)	Male (25)	Female (25)	Total (50)
Straight	23 (11.79%)	24 (11.70%)	47	13 (7.78%)	18 (11.76%)	31
Wavy	88 (45.13%)	83 (40.49%)	171	35 (20.96%)	23 (15.03%)	58
Curved	36 (18.46%)	42 (20.49%)	78	34 (20.36%)	44 (28.76%)	78
Circular	11 (5.64%)	34 (16.59%)	45	15 (8.98%)	28 (18.30%)	43
Non specific	5 (2.56%)	4 (1.95%)	9	8 (4.79%)	5 (3.27%)	13
Converging	1 (0.51%)	4 (1.95%)	5	7 (4.19%)	7 (4.58%)	14
Diverging	31 (15.89%)	14 (6.83%)	45	55 (32.93%)	28 (18.30%)	83
Total	195	205	400	167	153	320



Graph no. 1: Distribution of palatal rugae according to shape among both the genders for

Table 2 In both Indian and Tibetan population, males have rugae more in right side and females have more on left side of palate. More rugae are seen in Indian population as compared to Tibetan population

Palatal sides	Indian Population (50)		Tibetan Population (50)	
	Male (25)	Female (25)	Male (25)	Female (25)
Right	98 (50.25%)	100 (48.78%)	90 (53.89%)	72 (47.06%)
Left	97 (49.74%)	105 (51.22%)	77 (46.11%)	81 (52.94%)
Total	195	205	167	153

Table no. 3 : Statistical analysis to find correlation between various patterns among both populations

Patterns	Straight	Wavy	Curved	Circular	Nonspecific	Converging	Diverging
Population Indian/Tibetan							
t-test	0.946	5.944	1.774	-0.064	-1.501	1.254	2.897
p-value	0.351*	0.0001**	0.084*	0.949*	0.164*	0.230*	0.006*

*p-value > 0.05 is insignificant; **p-value < 0.05 is significant.

DISCUSSION

Palatal rugae pattern is are considered unique to an individual and hence it can be used as a valuable tool for person identification as similar to the finger prints. The aim of our study was to assess the uniqueness of palatal rugae in different ethnic population.

Analysing the palatal rugae pattern based on its shape than its length is subjected to less chance of inter observer error as there is obvious difference among various pattern ,we checked random samples from our study for the intra observer error using student t test and obtained a p value of 0.995, indicating that there is no significant intra observer error present.

The most prevalent repetition rugae pattern observed in our study was Wavy in Indian males and females followed by the curved pattern . Although the divergent pattern was seen most commonly in Tibetan males, it was followed by wavy and curved pattern in almost equal prevalence. However curved pattern was seen more predominantly in Tibetan females . This is in accordance with the study conducted by Nayak P et al³, in which they compared the southern Indian and western Indian population. The results were also much consistent with the study conducted by Hosmani et al¹², where they have included Indian and Tibetan population in their study.

Kapali et al¹⁶ conducted a study in Australian Aborigines and Caucasians, and found that there is a statistically significant association between rugae forms and ethnicity, straight forms being more common in Caucasians whereas wavy forms were more common in Aborigines ,while Abeer M. Abdellatif¹⁷ et al conducted a study among Egyptian and Saudi children and concluded that curved and wavy were the most prevalent rugae shape in both groups, followed by straight rugae. Circular, converged and diverged unifications were few in number.

Hence from the results obtained from the different studies we concluded that there is significant difference in palatal rugae pattern among population. Recent methods of palatal rugae identification include Calcorugoscopy, where the overlay print of palatal rugae in a maxillary cast, used in order to perform a comparative analysis¹³. Limson and Julian used a computer digital software which is commonly used in finger printing analysis where the pattern is analysed within medial and lateral extremities digitally and the plotted points are identified using specialized software, the researchers obtained 97% accuracy in this method.¹⁴ The uniqueness of the pattern , post-mortem stability and resistance, cost effective techniques with less instrumentation will make it as an important parameter in forensic identification.

CONCLUSION

Our study suggests that there is difference in palatal rugae for both Tibetan and Indian population and hence can be concluded the that rugae is having population specific configuration. However the study should be extrapolated to a larger scale of population for further validation of the results .Palatal rugae will also contribute as a guide in the forensic database for the future reference and application.

REFERENCE

- Jain A & Chowdhary R Palatal rugae and their role in forensic odontology Journal of Investigative and Clinical Dentistry 2013; 4:1-8
- Morlang WM. Forensic dentistry. Aviat Space Environ Med 1982; 53: 27-34
- Nayak P, Acharya AB, Padmini AT, Kaveri H. Differences in the palatal rugae shape in two populations of India. Arch Oral Biol 2007; 52: 977-82.
- English WR, Robison SF, Summitt JB, Oestrele LG, Brannon RB, Morlang WM. Individuality of human palatal rugae. J Forensic Sci 1988; 33: 718-26.
- Patil MS, Patil SB, Acharya AB. Palatine rugae and their significance in clinical dentistry: a review of the literature. J Am Dent Assoc 2008; 139: 1471-8.
- Allen H. The palatal rugae in man. Dent Cosmos 1989; 31: 66
- Campos ML. Rugosopia palatina. [Cited 18 dec 2018]. Available from: <http://www.pericias-forenses.com.br>
- Kieswetter K, Schwartz Z, Dean DD, Boyan BD. The role of implant surface characteristics in the healing of bone. Crit Rev Oral Biol Med 1996; 7: 329-45.
- Caldas IM, Magalhaes T, Afonso A. Establishing identity using cheilioscopy and palatoscopy. Forensic Sci Int 2007; 165:1-9
- Thomas CJ, van Wyk CW. The palatal rugae in an identification. J Forensic Odontostomatol 1988; 6: 21-7
- Shetty SK, Kalra S, Patil K, Mahima VG. Palatal rugae pattern in Mysorean and Tibetan populations. Indian J Dent Res. 2005;16:51-5
- Hosmani J, Gaddekar NB, Vijayalakshmi S. Kotrashetty, Nayak R, Babji D, and Mishra S "Comparison of palatal rugae pattern among Indian and Tibetan population". 2018 Jan-Apr; 10(1): 40-44.
- Pueyo VM, Garrido BR, Sanchez JA. Odontologia legal forense. Barcelona: Masson, 1994
- Limson KS, Julian R. Computerized recording of the palatal rugae pattern and an evaluation of its application in forensic identification. J Forensic Odontostomatol 2004; 22:1-4
- Selvamani M, Hosallimath S, Madhushankari, Basandi PS, Yamunadevi A

- Dimensional and morphological analysis of various rugae patterns in Kerala (South India) sample population: A cross-sectional study 2015 jun 6(2): 306-309
16. Kapali S et al Palatal rugae patterns in Australian Aborigines and Caucasians Australian Dental Journal 1997;42(2):129-33
 17. Abeer M. Abdellatif, Salwa M. Awad and Shaza M. Hammad Comparative study of palatal rugae shape in two samples of Egyptian and Saudi children PEDIATRIC DENTAL JOURNAL 21(2): 123-128, 2011
 19. The Glossary of Prosthodontic Terms. J Prosthet Dent. (8th ed) 2005;94:28.