Characteristics Of Patterns Of Palatal Rugae In Central Indian Individuals: A Cross-Sectional Study

Dr. Ninad Nagrale *Associate Professor, Forensic Medicine & Toxicology,*
Datta Meghe Medical College, Nagpur-441110.
Dr. Ranjit S. Ambad *Associate Professor Dept. of Biochemistry,*
Datta Meghe Medical College, Nagpur-441110.
Dr. Nandkishor Bankar *Assistant Professor Dept. of Microbiology*
Datta Meghe Medical College, Nagpur-441110.
Dr. Harsh Salankar *Professor Dept. of Pharmacology*
Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences,
Sawangi (Meghe), Wardha-442001

Address for Correspondence
Dr. Ranjit S. Ambad
Associate Professor Dept. of Biochemistry,
Datta Meghe Medical College, Nagpur-441110.
Emai.id. ambad.sawan@gmail.com Mob No. 09917999919

ABSTRACT
Background: Palatal-Rugae refer to the ridges on either side of the median palatal raphe & on the anterior part of the palatal mucosa, behind the incisive papilla. Numerous studies on various individuals have identified definiterugal trends within each group.
Aim: The different patterns of Palatal-Rugae among the individuals of Central India are studied, evaluated & documented & compared with the patterns described in the literature that can assist as an additional method of identification in cases of crime or mass disasters.
Material & Methods: Pre-orthodontic casts of 200 samples (100 males & 100 females) have been selected. The method for defining the pattern of rugae used was Thomas et al. The different types of rugae among males & females have been analyzed statistically in the literature & compared with other studies.
Results: A statistically insignificant (p >0.05) higher mean primary rugae score was observed in males (7.32 ± 2.78) while higher secondary (3.72 ± 2.24) & tertiary (2.88 ± 1.36) rugae score were observed in females. Both genders displayed predominance in the wavy shape of distribution (males= 4.76 ± 1.64 & females= 4.18 ± 1.56). Commonly observed trends converged (58%) in males & diverged patterns (62%) among females in the unification mode, which was statistically significant (p= 0.04).
Conclusions: The findings showed a clear rugal pattern in this group, relative to other individuals reported in the literature. Palatal-Rugalpatterns are definitely associated with geographic variation & may act as an additional tool for assisting in forensic identification procedures.

Key words: Palatal-Rugae, Human identification, Central India.

INTRODUCTION

Human identification is one of the key areas of research both in antemortem & postmortem instances. The importance of dental analysis in human identification, by comparing ante-mortem & post-mortem records, remains one of the most reliable & widely used techniques by forensic odontologists. Forensic dental identification mainly involves determining the sex, age, ethnic back-ground, culture, etc. of the person. Also known as rugaepalatinae or

plicaepalatinaetransversae, Palatal-Rugaerefers to a series of transverse ridges on either side of the median palatal raphe & on the anterior part of the palatal mucosa behind the incisive papillae.It has been noted in mice that even before palatal shelf elevation, Palatal-Rugae emerge as localized areas of epithelial proliferation in the 3rd month of IUL. Condensation of fibroblasts accumulates under the epithelial thickening in the connective tissue, giving a distinctive rugal pattern. It is one of the methods used by a forensic odontologist in human identification because of its internal function, stable in nature, perennity, uniqueness & low use costs.Rugal length & transverse palatal rugal region width in both genders increase with age & stop before the somatic growth stops. There also seems to be a clear connection between the types of rugae & ethnicity, as the patterns of Palatal-Rugae that were unique to that particular group were reported by various writers. In a forensic setting, it is necessary to include an ethnic group evaluation as an aid to personal identification.

Material & methods
The study material consisted of 200 dental pre-orthodontic casts of 100 males & 100 females from Central India's 20-40 age group. All the participants were stable individuals free from congenital abnormalities, inflammation, trauma or orthodontic treatment. All castings were free of air bubbles or voids, especially in the anterior third of the palate. The classification scheme of Thomas et al was adopted for the identification of rugae. This includes the study of the number, length, form, & unification patterns of rugae. Rugae models have been illustrated using a fine graphite pencil.
Statistical Analysis: Recorded data was collected & entered into a spreadsheet software (Microsoft Excel 2007) & then exported to the Data Editor SPSS version 15. Unpaired t tests & Chi square tests were used for comparison of mean & relation between the attributes. For all the tests, confidence intervals & p-values were set at 95 percent & 0.05, respectively.

Results
The average number of Rugae in the study sample was 1210 in males & 1306 in females. Mean primary rugae were higher in males (7.32 ±2.78) while secondary rugae (3.72 ± 2.24) & tertiary rugae (2.88 ± 1.36) were higher in females, but the results were statistically insignificant (p>0.05). Based on the shape of Palatal-Rugae , both sexes displayed a wavy type (males = 4.76 ± 1.64 & females = 4.18 ± 1.56), followed by a straight distribution type (males = 3.6 ± 2.68 & females = 3.24 ± 1.58). However these results were statistically insignificant (p>0.05). In males & diverging patterns (62 percent) among females with a p value of 0.04, the gender distribution of the rugae unification mode showed prevailing converging trends (58 percent), suggesting that the gap is statistically significant.

Discussion
Forensic human identification requires the determination of various requirements for both living & deceased, such as age, sex, ethnicity or geographical region. Palatal rugoscopy is one such method which is successfully used to identify an individual on the basis of the analysis of the rugal pattern, as it has been shown to be significantly unique in type, length, width, prominence, number & orientation among individuals. There is also a disparity on the right & left sides of the same individual, i.e. there is no bilateral symmetry in the pattern of rugae. Rugal patterns may also be used in individual identification by comparing the specifics of postmortem rugae with the antemortem records. Thomas et al[1,2,3] announced in 1987 that a badly burned edentulous body was detected with the assistance of plaster casts made from the dentures in the victim's mouth & compared to another set found in that individual's home.In order to simulate the identification of rugae in cases of incineration & decomposition, a study of rugae in burn victims & cadavers was carried out by Muthusubramanianet al[4]. They reported that 93% of palatine rugae were normal & 77% of palatine rugae showed no colour change among subjects with third-degree pan-facial.The use of casts made from jaws rather than dentures was suggested by Sognnaes[5] for a more precise result. Dohke& Osato[6] suggested that among the Japanese, females had fewer rugae than males. Through their longitudinal & cross-sectional approaches, Kapali et al[7]analyzed changes in rugae trends with age in Australian Aborigines & compared the patterns between Australian

Aborigines & Caucasians. They used classifications defined by Lysell[8]& Thomas & Kotze. Fahmi et al[9]analyzed the patterns of rugae in Saudi males & females. The authors reported that females showed a significant difference in the converge. In 2007, Nayak et al[10] investigated the possible difference in the form of rugae between Southern Indians & Western Indians, as well as the utility of rugae in the classification of individuals using discriminant function analysis.In 2010, the number & pattern of Palatal-Rugae among the Madhya Pradesh & Kerala individuals in India were determined by Paliwal et al[11]& indicated that the straight rugal pattern among males on the right side of the palate was significantly predominant compared to the Madhya Pradesh individuals.Comparing Japanese & Indian children with palatine rugae & hard palate form, Kashima et al[12] suggested that Japanese children had more primary rugae than Indian children. Shetty et al[13] reported in a comparative study between Indians & Tibetan individuals that Indian males had more primary rugae on the left side compared to females & vice versa for the Tibetan individuals. In our study ahigher converging pattern in males & a higher diverging pattern in females were seen. As such patterns that serve as ante-mortem documents, which could be used in forensic odontology identification procedures, the Palatal-Rugae pattern storage database must be created[14,15].

CONCLUSION
We observed the presence of a specific rugal pattern in the Central Indian individuals in comparison with other individuals reported in the literature. This study thus highlights that the pattern of Palatal-Rugae in the comparative identification method could be used as one of the adjuncts of forensic odontology. Due to the geographical variation of the Rugal pattern in different individuals, the rugae database, which will serve as a forensic reference centre, needs to be created.

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Table 1: Mean distribution of the research sample according to the number & shape of Palatal-Rugae by sex

Gender	Number			Shape			
	Primary	Secondary	Tertiary	Straight	Wavy	Curved	Circular
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Males (n=100)	748 (7.32±2.78)	276 (2.64±1.45)	186 (2.26±1.45)	390 (3.6±2.68)	482 (4.76±1.64)	152 (2.38±1.04)	186 (2.46±1.84)
Females (n=100)	710 (6.54±1.32)	338 (3.72±2.24)	256 (2.56±1.84)	384 (3.24±1.58)	478 (4.18±1.56)	148 (2.83±1.56)	294 (3.32±2.12)

Table 2: Unification pattern study of males & females

Gender	Unification pattern	Unification within gender (%)	p-value
Males (n=100)	Converging	58	0.04*
	Diverging	42	
Females (n=100)	Converging	38	
	Diverging	62	