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RESEARCH ARTICLE

ASSESSING THE INHERITANCE OF PALATAL RUGAE PATTERNS

Dr. Rajesh N. Patel^{1*}, Dr. Umesh K.¹, Dr. Sangeeta¹, Dr. Rahul Patel¹, Dr. Hiren Patel¹, Dr. Nishan Patel²
Dr. Chintan K. Patel³, Dr. Nidhi Sabhaya¹, Dr. Avani Bhanushali¹

¹Department of Public Health Dentistry Narsinhbhai Patel Dental College & Hospital, visnagar

²Department of Pediatric and Preventive Dentistry Narsinhbhai Patel Dental College & Hospital, visnagar

³Karnavati School of dentistry, Uvarsad, Gandhinagar.

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***Corresponding Author**

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Dr. Rajesh N. Patel

Abstract

Introduction- Palatal rugae patterns provide us important information in forensic identification. Palatal rugae are unique to each person but basic rugae patterns could still have similarities within family.

Aim and Objectives: The present study was carried out to ascertain whether there is any hereditary pattern in palatal rugae patterns between offspring's and their parents. Methodology: It is a cross sectional study which constituted 30 families. Parents and their offspring (son or daughter) of each family were selected. The palatal rugae impression was recorded by using an alginate impression material and appropriate perforated metal tray for all subjects. The palatal rugae patterns of the offspring that matched with either of the parent was noted and recorded. The data was subjected to contingency coefficient and spearman's correlation coefficient tests.

Results: In general, Rugae patterns of offspring were similar to either of their parents. There was statistically significant resemblance of offspring palatal rugae patterns with either of their parents was found with (P value < 0.05).

Conclusions: The use of palatal rugae in forensic identification is advantageous because of their low utilization cost, simplicity and reliability

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INTRODUCTION

Individual identification is an important and challenging task in forensic investigation, which was based on scientific principle. Forensic pathology a branch of forensic medicine is a narrower field involves collection and analysis of medical evidence (samples) to produce objective information for use in the legal system. [1] The primary tool of forensic medicine has always been the autopsy. Forensic medicine is a science that deals with the relation and application of medical facts to legal problems. [2] It is difficult to identify a person according to various identification measures when traffic accidents, acts of terrorism or mass disasters occur. [3]

Modern techniques use specimens like semen, blood, and hair samples of the criminal found in the victim's bodies, and compared to the defendant's genetic makeup, known as DNA fingerprinting technique which is applied in identify the body of a victim. [4] Dentists who work in forensics now can establish a constructive identification of humans, sometimes in a matter of minutes, even devoid of dental records. Forensic medicine is a morbid subject but necessary to say the least. Forensic odontological identification by their nature are multidisciplinary team efforts relying on positive identification as well as presumptive or exclusionary methodologies. [5] The forensic dentist can reliably ascertain an individual's characteristics and is performed through dental identification by analyzing the teeth and the oral cavity. [6] Recognition is done by the comparison of ante mortem and post mortem dental records and using the unique features visible on dental radiographs. [7]

Dental records, fingerprint and DNA comparisons are probably the most common techniques used in this context, allowing fast and reliable identification processes.^[8] However, under certain circumstances, catastrophic accidents involving plane crashes, fires and explosions can destroy the finger prints so they cannot always be used; but interestingly palatal rugae patterns are preserved. Sometimes it is necessary to apply different and less known technique which is palatal rugae patterns, can lead us to important information and help in a person's identification. Various investigators have implied that palatal rugae are unique to each individual and they can be used successfully in human identification. However, researchers have disagreed as to whether or not legal identification could be based solely on palatal rugae^[9, 10]. Palatine rugae are irregular, asymmetric ridges of mucous membrane extending laterally from the incisive papilla and the anterior part of the median palatal raphe.^[11]

Palatal rugae have been shown to be highly individual and consistent in shape throughout life and are protected in the oral cavity vault i.e. surrounded by cheek, lips, tongue and buccal pad of fats, that gives protection in cases of incineration or trauma.

When other methods are difficult for identification, rugae may be considered to be an alternative source of information enabling the search field to be easy and short term. Palatal rugae also known as *plicae palatinae transverse* are transverse ridges on anterior part of palatal mucosa, behind the incisive papilla.^[12] These are anatomical folds formed by irregular fibrous connective tissue, despite the ongoing problem of describing palatal rugae patterns qualitatively and quantitatively, their uniqueness to individuals has been recognized as a potentially reliable source of identification.^[2] If established that, there is a hereditary pattern in palatal rugae patterns, it can be an important tool in personal identification and determining familial lineage of a person. Therefore, present study was carried out to ascertain whether there is any hereditary pattern in palatal rugae patterns, and thereby, to investigate the potential role of palatal rugae in personal identification.^[13]

Thus, the current study was undertaken to assess the correlation of palatal rugae patterns among family members visiting the hospital.

Materials and Method

It is a cross sectional study carried out on the patients visiting the Hospital. The study population was selected from patient's visiting to oral medicine department by non-probability convenience sampling method. A total of 30 families (Father, mother, and their child of each family) were selected in the study. Prior written informed consent was taken from each subject; In case of minor subject, consent was taken from either of the parents. Subjects who are healthy and free of congenital abnormalities were included in the study. Subject with Palate and lip defect, wearing partial dentures and braces, Congenital anomalies / malformation, Previous orthodontic surgery, Allergic to impression materials, Deformity, scars and Trauma of the palate, Palatal lesions like ulceration, torus palatine, cystic lesion, palatal fracture, oro-antral fistula, smoker's palate, etc. were excluded from the study.

Impressions:

Impression trays were selected according to the shape and size of the patient's upper arches. Two scoop of alginate powder was mixed with 40 ml of water (using a measuring jar provided by the manufacturer), in a water/powder (W/P) ratio of 40 ml: 15 g, in a flexible rubber bowl with a mixing spatula. A strong figure of eight motion was used for mixing. The mix was immediately transferred to the impression tray for insertion into the patient's mouth. The tray was held inertly and static during the setting of impression material. After about 2 minutes (setting time of Alginate), the tray was separated from the teeth to avoid rocking and possible deformation of the fine areas of the impression. Surplus material at the edge was trimmed. Type III Dental stone was used to prepare the cast. The cast was separated from the impression after 60 minutes. Base for the study casts was made using the base former and dental stone. Each cast was numbered for identification. The rugae were highlighted by a sharp graphite pencil on the cast and a magnification lens was used for identification.

Method of identification:

Palatal rugae pattern seen as elevated impression were marked on these casts using normal sharp graphite black color pencil and magnifying lens, then cast were analysed using the classification given by Thomas and Kotze classification⁽¹⁴⁾ (Figure – 1).

(Figure-2) Shows the study models used in the study. The method of identification was based on Thomas and Kotze classification in 1983.

Statistical Analysis:

The collected data was entered in to Microsoft excel 2007 and subjected to statistical analysis using Statistical package for Social Sciences (SPSS version 18.0). The results were evaluated by contingency coefficient test and spearman correlation coefficient tests.

Results:

The present study was carried out to assess whether there is any hereditary pattern in palatal rugae patterns between the offspring's and their parents.

It was sensible that out of 30 families, 29 families the shape of rugae pattern in offspring matched with either of parents. In unification pattern all 30 offspring's palatal rugae pattern matched with either of parents. (Table. 1)

A total of 692 palatal rugae were observed in 30 families, palatal rugae were separated on either side of palate by mid palatine raphe.

The correlation of palatal rugae patterns, contingency coefficient score of father - offspring and mother - offspring (0.701, 0.741) respectively which suggest positive correlation in shape pattern between offspring and their parents. This correlation is statistically significant (P value 0.000). The contingency coefficient score of father - offspring and mother - offspring (0.428, 0.062) respectively, which suggest a significant co - relation of unification pattern of palatal rugae seen between offspring and their father (P value 0.010), and no significant co - relation seen between offspring and their mother (P value 0.735). (Table.2)

Fig.1: Palatal rugae shape patterns

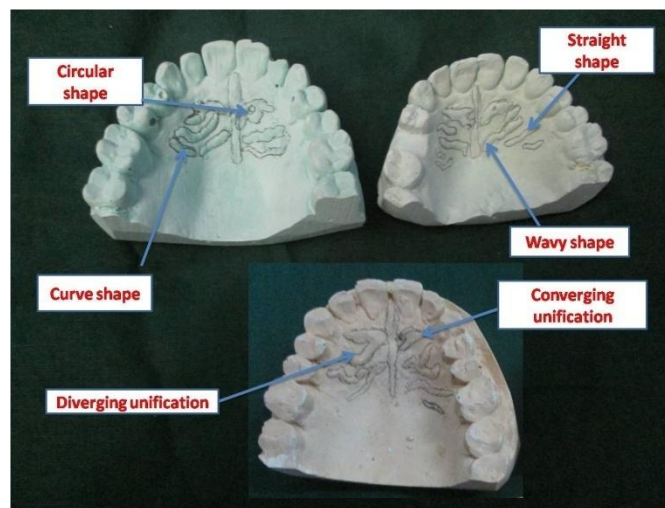


Table 1: Distribution of study subjects based on palatal rugae pattern

Sr. No	Palatal rugae patterns		Offspring	Mother	Father	Rugae pattern. In offspring Matching With Either of Parents
1	Shape	Curved	2	2	1	1
		Wavy	27	27	25	27
		Straight	1	1	2	1
		Circular	0	0	2	0
2	Unification	Diverging	29	27	26	29
		Converging	1	3	4	1

Table 2: Contingency coefficient shows correlation of Palatal Rugae Pattern among study subjects

Sr. no	Palatal rugae pattern	Pair of family members	Contingency coefficient value	P value
1	Shape	Father and offspring	0.701	0.000
		Mother and offspring	0.741	0.000
2	Unification	Father and offspring	0.428	0.010
		Mother and offspring	0.062	0.735

P value ≤ 0.05 significant correlation

P value ≥ 0.05 no significant correlation

Discussion

Palatal rugae due to their special features have been widely used in population identification. Palatal rugoscopy was first proposed in 1932, by a Spanish investigator named Trobo Hermosa. It was not until 1955 that a proper classification of palatal rugae was put forward by Lysell.^[15] This classification was modified by Thomas and Kotze in 1983 and it was considered to be the most acceptable one. It has also been proven that rugae maintain a constant shape throughout life and may be specific to racial groups facilitating population identification

Palatal rugae have been studied for various reasons, the most important one being for personal identification in the field of forensic odontology

It is widely acknowledged that there are limitations in identification by fingerprints, dental records and DNA in some forensic situations.^[2]

However, visual identification and use of fingerprints are limited by post-mortem changes associated with time, temperature and humidity.^[16] Although teeth are more durable than other parts of the body, identification via dental records also may prove to be inconclusive, because dental treatment might have been performed between the creation of a dental record and the person's death. DNA profiling is accurate, but it is expensive and time consuming for use in large populations. Since it is a well-established fact that the rugae pattern is as unique to a human as are his or her fingerprints and it retains its shape throughout life. The anatomical position of the rugae inside the mouth - surrounded by cheeks, lips, tongue, teeth, bone and buccal pad of fat,—keeps them well-protected from trauma and high temperatures. Thus, they can be used reliably as a reference landmark during forensic identification.^[17]

Palatal rugae have been shown to be highly individualistic and consistent throughout the life. It is well-established fact that the palatal rugae pattern is unique to human being, as his fingerprints. Once formed, they do not undergo any change except in length, due to normal growth, and remain in the same position throughout individual's life time. Diseases, chemical aggression, or trauma do not seem to be able to change the palatal rugae form. It is also concluded that changes that occur from orthodontic movement, extraction, aging, and palatal expansion do not modify the rugae enough to hamper identification.

Palatal rugae are used in human identification not only due to their singularity and unchangeable nature, but also due to other advantages, namely their low utilization costs.^[18]

The present study was carried out to ascertain whether there is any similarity in palatal rugae patterns between offspring's and their parents.

A total of 30 families visiting the Narsinhbhai patel dental college and hospital, visnagar were included in this study. Each palatal rugae pattern of the 30 offspring was compared with the corresponding palatal rugae patterns of his or her parents (Fig.1).

In view of the fact that there is a dearth in literature studying the hereditary pattern of palatal rugae, Comparison of results is limited as the literature review identified no other study conducted with the similar objective.

Based on our study, it is sufficiently characteristic to discriminate between individuals because no two palates are alike in their rugae configuration. Hence, palatal rugae can be one of the tools for personal identification in forensic odontological identification in the Indian context It concludes that there was statistically significant resemblance of offspring palatal rugae patterns with parent's palatal rugae patterns. The present study obtained statistically significant results in study subjects; hence further detailed study is required to draw final conclusions. Our result indicates the role of heredity in palatal rugae patterns.

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