Available online at https://www.mmpubl.com/

International Journal of Forensic Oodntology

ORIGINAL ARTICLE

ASSOCIATION BETWEEN PALATAL RUGAE PATTERN AND DENTAL CARIES AMONG THE GENERAL POPULATION: A CROSS-SECTIONAL STUDY

Prabhu Subramani,[1] Y. Saraswathi Lakshmi,[1] K. Sarika,[1] S. Shalini.[1]*

[1]Department of Public Health Dentistry, Asan Memorial Dental College and Hospitals, Chengalpattu, Tamil Nādu, India

How to cite: Subramani P, Lakshmi SY, Sarika K, Shalini S. Association between palatal rugae pattern and dental caries among the general population: A cross sectional study. Int J Forensic Odontlogy.2022.7;2:20-25.
DOI: https://doi.org/10.56501/intjforensicodontol.v7i2.575

Received on: 11-9-2022 Accepted on: 26-09-2022 Web Published on: 12-10-2022

ABSTRACT

Background : Palatal rugae appear in the 3rd month of intrauterine life around six different types of rugae patterns have been recognized at present, which might have a potential implication in human identification.

Aim : The aim of this study is to determine the association between dental caries and palatal rugae pattern among the general population.

Materials and Methodology: A cross-sectional study was conducted among n = 230, out patients reporting to Asan Memorial Dental College and Hospital. Palatal rugae identification was done using photographs. Canon EoS 60D digital single-lens reflex camera with a 100 mm macro lens was used along with retractors and dental mirrors for identification of the rugae pattern and decayed, missing and filled teeth (DMFT) scoring was done for recording dental caries.

Results: The number of rugae varies across gender ($P < 0.05$) and caries-free individuals had higher number of rugae than individuals with DMFT >1 ($P < 0.05$ – statistically significant).

Conclusion : Rugoscopy can be used as a screening method to provide adequate preventive treatment by showing the higher risk of caries detection.

Keywords : Dental caries, rugae pattern, rugoscopy

Address for Correspondence:
Y. Saraswathi Lakshmi
Department of Public Health Dentistry,
Asan Memorial Dental College and Hospitals, Chengalpattu,
Tamil Nādu, India
E-mail: yatamsaraswathi@gmail.com

INTRODUCTION

The palatal rugae are unique structures which are inalterable in their position and pattern throughout the lifetime of an individual.[1] Palatal rugae are irregular asymmetric ridges of mucous membrane extending laterally from the incisive papilla to the anterior part of median palatal rugae. They appear during the 3rd month of intrauterine life and occupy most of the length of palatal shelves. Palatal rugae have potential implications in the process of human identification and play a special role in forensic dentistry, In case of trauma or incineration, palatal rugae are not affected much, due to its anatomical position and they are also used in gender predilection such that the rugae pattern plays a potential role in identification.[2] It has been noted that there was an increased number of palatal rugae in males when compared to females-In a study done by Gautam et al. In Orthodontics, the rugae pattern is used as reference landmarks for the superimposition of cephalometric tracings.[3] Dermatoglyphics and the rugae pattern are the genetic markers where both palatal rugae and enamel forming tooth buds have the same ectodermal origin.[4] Such that they can be a predictor of dental caries, where one may cause the changes on the other or vice versa and both dactyloscopy and rugoscopy are unique in every individual. The most common problem a dentist encounter in a patient is dental caries. According to Shafer, dental caries is a biofilm-mediated, sugar-driven, multifactorial, and dynamic disease that results in repeated phases of demineralization and remineralization of dental hard tissues which is usually associated with poor oral hygiene maintenance, lack of proper knowledge about brushing technique, and improper diet pattern. They occur in both primary and permanent dentition and can damage the whole crown structure of the tooth and affect the pulpal tissues also which in turn causes periapical infection.[5] It will be a privilege for the dental practitioner if it is easy to predict the occurrence of dental caries which will improve the patient's oral health status,[4] hence the aim of this study is to evaluate the relationship between palatal rugae pattern and dental caries among the general population.

MATERIALS AND METHODOLOGY

A cross-sectional study was conducted among outpatients reporting to Asan Memorial Dental College and Hospital (AMDCH), Chengalpattu. The sample size for the current study was estimated to be n = 230, based on the study conducted by Devi et al.[5] using OpenEpi software, before the start of the study approval was obtained from the Institutional Scientific Review Committee of AMDCH. Outpatients aged more than 18 years with no dental pain on the day of examination were included in this study. Patients with congenital anomalies, trauma of maxillofacial region, history of systemic illness, and medications altering the salivary flow of the patient were excluded from the study.

To assure and improve inter-examiner reliability, practical calibration sessions for the palatal rugae pattern identification were performed before the onset of the study in the Department of Public Health Dentistry, AMDCH, and the inter-examiner reliability was calculated using Kappa statistics (∃0.88).

Method of pattern identification

Identification of the palatal rugae was done using photographs. The photographs were taken with a canon EOS 60D digital single-lens reflex camera with a 100 mm macro lens using retractors and dental mirrors. To ensure reliable results, the photography procedure was standardized. A bowl of hot water was used to avoid fogging of the mirror.[6] The palatal rugae identification was based on the classification of Thomas and ktozs palatal rugoscopy.[7] According to Thomaz and Kotze Classification of Palatal Rugae [Figure 1]

Table 1: Distribution of study participants according togender

Gender	*n*-mean, *n* (%)
Male	63 (27.4)
Female	167 (72.6)
Total	230 (100)

Table 2: Comparison of rugae pattern across gender

Rugae pattern	Gender, mean±SD		*P*
	Male	Female	
Straight	0.39±0.67	0.67±1.05	**0.03***
Wavy	3.14±1.19	2.77±1.62	**0.26**
Curved	1.64±1.32	1.89±1.70	**0.63**
Divergent	1.15±1.27	1.01±0.93	**0.80**
Convergent	0.17±0.42	0.27±0.52	**0.31**
Circular	**0.15±0.41**	**0.21±0.49**	**0.59**

Table 3: Comparison of rugae pattern and dental caries

Rugae pattern	DMFT absent			DMFT present		
	<3 rugae	4-6 rugae	>6 rugae	<3 rugae	4-6 rugae	>6 rugae
Straight	94	0	0	134	1	**1**
Wavy	60	30	4	91	43	**2**
Curved	78	15	1	116	19	**1**
Divergent	91	3	0	133	3	**0**
Convergent	94	0	0	136	0	**0**
Circular	**93**	**0**	**1**	**138**	**0**	**0**

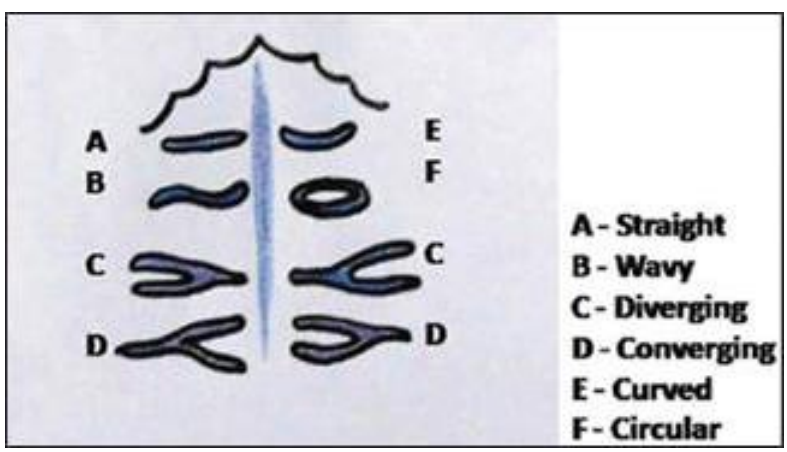

Figure 1: Thomas and Kotze classification of rugoscopy (credit: Thomas and Kotze)[7]

Palatal rugae were classified according to: Size, shape, direction, and unification

- Based on size, the rugae were classified as: Primary, secondary, and fragmentary
- Based on shape, the rugae were interpreted as: Curved, wavy, straight, and circular
- Based on direction: Forward directed and backward directed
- Based on unification pattern, primary rugae were classified as: Converging and diverging.

Recording of the dental caries was done using decayed, missing and filled teeth (DMFT) index scoring with the WHO criteria,[8] and the statistical analysis was performed with SPSS version 23.

RESULTS

Table 1 depicts the distribution of the study participants according to gender among the study participants male were 63 (27.4%) and female were 167 (72.6%). Various shape of the rugae pattern was recorded among the study population depicted in Table 2.

Table 2 shows the comparison between the mean number of rugae across the gender which showed a significant difference between the gender and each palatal rugae pattern, The data follows a nonparametric distribution based on the Kolmogorov–Smirnov test, hence analysis was done using the Mann–Whitney U test where the $P < 0.05$ (statistically significant). According to the study results, there was more number of straight patterns in females compared to males.

Table 3 shows the comparison between rugae patterns and dental caries. Based on this, the population was classified as caries-free and caries active. The Chi-square test for association showed that the individuals with DMFT >1 had more number of rugae regardless of the shape of rugae, compared to those free from caries. Therefore, there exists association between the number of rugae and dental caries among the study population ($P < 0.05$ – statistically significant).

DISCUSSION

The characteristics of palatal rugae are unique to every individual.[1] The palatal rugae play a major role in mastication, deglutition, and speech.[9] Dental caries is caused by host, agent, and environmental factors, hence the dermatoglyphic and palatal rugae patterns can be used as oral health markers in the early prediction of dental caries.[10]

The arrangement and the number of palatal rugae patterns in mammals are species-specific[11] which is asymmetrical and an exclusive feature of human beings.[12] In the 3rd month of intrauterine life palatal rugae appear in the oral cavity which is derived from epithelial-mesenchymal interactions by covering connective tissue in the palatine process of the maxillary bone.[13] In the stage of embryo, palatal rugae are relatively prominent which covers at most the length of the palatal shelves, whereas during the time of fetal growth it becomes less prominent followed by the newborn stage it gets confined to the anterior part of the secondary palate[14,15]. The number of rugae pattern remains the same and does not change throughout the life.[16] According to Thomas and Kotze classification of rugae pattern, the palatal rugae are categorized into two armed rugae as “branches”/ unification depending on the length of their origin which is classified into converging/diverging. Based on the length of the rugae pattern, they are categorized into primary (5 mm), secondary (3–5 mm), and fragmentary 2–3 mm. Studies have shown that there was a significant difference between males and females with rugae patterns.[17] Some studies have stated that there was insignificant sexual

dimorphism in the rugae pattern.[1] However, the present study stated that there was significance, i.e., there was increased number of straight patterns of rugae in females compared to that of males ($P < 0.05$).

In this study, there was DMFT >1 in individual having more number of rugae regardless of the shape of rugae compared to those who are free from caries. This shows a significant association between the number of rugae and dental caries. The present study was the first of its kind to our knowledge in comparison of dental caries and palatal rugae; hence, there is paucity in comparison with the literature. The limitation of the study was the population size and distribution of the individuals cannot be made evenly. Technological advancements like three-dimensional scanners and measurement can be done in a complex screen.

CONCLUSION

The association between number of rugae and dental caries is statistically significant. This screening method using palatal rugae pattern can detect patients with high incidence of dental caries.

Financial support and sponsorship - Nil

Conflicts of interest - There are no conflicts of interest

REFERENCES

1. Fatima F, Fida M, Shaikh A. The association between palatal rugae pattern and dental malocclusion. Dental Press J Orthod 2019;24:37.e1-9.
2. Bhateja S, Arora G, analysis of palatal rugae for human identification (Mathura) population. Indian J Dent Sci 2013;5:24-7.
3. Gautam N, Patil SG, Krishna RG, Agastya H, Mushtaq L, Kumar KV. Association of palatal rugae pattern in gender identification: An exploratory study. J Contemp Dent Pract 2017;18:470-3.
4. Hoggan BR, Sadowsky C. The use of palatal rugae for the assessment of anteroposterior tooth movements. Am J Orthod Dentofacial Orthop 2001;119:482-8.
5. Devi M, Shahnaaz Sayima HA, Therraddi Muthu RM, Baburathinam S. Role of rugoscopy and dactyloscopy I predilection of dental caries in children. Indian J Public Health Res Dev 2020;11:???. [doi: 10.37506/ijphrd.v11i5].
6. Çifter M. A qualitative analysis of dental photography in orthodontics: The patient's perspective. Biomed Res Int 2018;2018:5418592.
7. Thomas CJ, Kotze TJ. The palatal rugae pattern: A new classification. J Dent Assoc S Afr 1983;38:153-7.
8. Petersen PE, Baez RJ. Oral Health Surveys: Basic Methods. 5th ed. ???: World Health Organization. (NLM Classifi Cation: WU 30)
9. Nunzi MG, Pisarek A, Mugnaini E. Merkel cells, corpuscular nerve endings and free nerve endings in the mouse palatine mucosa express three subtypes of vesicular glutamate transporters. J Neurocytol 2004;33:359-76.

10. Vijender V, Tarannum T, Pathak A. Dermatoglyphics interpretation of dental caries: An in vivo study. Int J Dent Med Res 2015;1:54-6. 6. Sanghani PH, Soni HK, Joshi MU. Correlation of dental caries in pediatric cases. Indian J Dent Sci 2017;8:131-4.

11. Buchtova M, Tichy F, Putnova I, Misek I. The development of palatal rugae in the European pine vole, microtus subteraneus (Arvivolidae, Rodentia). Folia Zool 2003;52:127-36.

12. Simmons JD, Moore RN, Erickson LC. A longitudinal study of anteroposterior growth changes in the palatine rugae. J Dent Res 1987;66:1512-5.

13. Amasaki H, Ogawa M, Nagasao J, Mutoh K, Ichihara N, Asari M, et al. Distributional changes of BrdU, PCNA, E2F1 and PAL31 molecules in developing murine palatal rugae. Ann Anat 2003;185:517-23.

14. Hauser G, Daponte A, Roberts MJ. Palatal rugae. J Anat 1989;165:237-49.

15. Waterman RE, Meller SM. Alteration in the epithelial surfaces of human palatal shelves prior to and during fusion: A scanning electron microscope study. Anat Rec 1974;180:111-36.

16. Kapali S, Townsend G, Richards L, Parish T. Palatal rugae patterns in Australian aborigines and Caucasians. Aust Dent J 1997;42:129-33.

17. Saraf A, Bedia S, Indurkar A, Degwekar S, Bhowate R. Rugae patterns as an adjunct to sex differentiation in forensic identification. J Forensic Odontostomatol 2011;29:14-9.

Published by MM Publishers
https://www.mmpubl.com/ijfo