Research Article,

Differences of Palatal Rugae Patterns between Chinese and Indian Female

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Abstract:
Palatal rugae are irregular protrusions that are anatomically located on the anterior maxillary mucous membrane, on each side of the median palatal raphe next to the posterior incisor papilla. The aim of this research was to determine the differences of palatal rugae pattern between Chinese and Indian females. This study was descriptive by using the observation method to a total of 50 female samples consisted of 30 Chinese and 20 Indian using purposive sampling. Impressions of the upper jaws were taken and cast with dental stone. The palatal rugae pattern was identified according to Martin dos Santos classification. The most frequent palatal rugae pattern in Chinese females is curve form (41.00%), followed by line form (23.85%) and sinuous form (15.90%). On the other hand, Indian females mostly have sinuous form (28.83%), followed by line form (23.93%) and curve form (20.25%). Thus, there is a difference between palatal rugae pattern between Chinese and Indian females which is the curve forms is more common in Chinese females while the sinuous forms is more common in Indian females.

Keywords: Palatal rugae pattern, Chinese Female, Indian Female

Interoduction:

The palatal rugae, also called "plica palatinae transversae" or "palatine rugae", are irregular protrusions that are anatomically located on the anterior maxillary mucous membrane, on each side of the median palatal raphe next to the posterior incisor papilla. The length of the rugae will remain unchanged from the age of 10 and its shape, direction and integration will remain stable throughout life.[1] As soon as the rugae is formed, it will not change and will remain in its position except in length as it follows the growth process. The rugae position is anatomically surrounded by the cheeks, lips, tongue, teeth, and a fat pad next to the buccal. This allows the rugae to remain protected in the event of an accident such as fire or a heavy impact.2 Palatal rugae can withstand postmortem decomposition changes for up to seven days after death and can withstand massive thermal attacks such as third degree burns.[3] Thomas and Van Wyk were able to identify the toothless and severely burned bodies of the fire victims by comparing the victim's rugae with the pattern of

the victim's old dentures. This had proven that rugae are stable during adult life. Thus, palatal rugae can be used as an ideal forensic identification parameter because of its uniqueness, postmortem resilience, and stability.[4]

Palatal rugae are formed in the third month in utero from the hard connective tissue covering bone.[5] Rugae are relatively prominent and occupy most of the length of the palatal shelves at the time of their elevation. At the next stage of embryonic development, five to seven somewhat symmetrical protrusions are formed. The formation of this protrusion starts from the anterior part of the raphe which then develops laterally. Towards the end of intra-uterine life, the rugae pattern becomes less regular, the posterior rugae disappears and the anterior part becomes clearer and denser.[1]

Histologically, the rugae are stratified squamous (layered scales), mainly parakeratinized, epithelium on a connective tissue base, similar to the adjacent tissue of the palate.[5] Fibroblast and collagen fibers accumulate in the connective tissue beneath the epithelium and have an unique

orientation.[2] The amount of rugae varies between three and seven on each side of the palate. The shape, length, number, orientation and inclination of rugae to the sagittal plane can differ significantly between the left and right sides of the same person and vary considerably among people.[6] In general, neither in the number of primary rugae nor in their distribution from the midline is found to be bilateral symmetry. It was found that there was slightly more rugae in males and on the left in both sexes.[7]

The variation of characteristics in cranial index of Caucasoid and Mongoloid are specific to each race, in which palatal rugae that is attached to maxilla will show difference in each race. Palatoscopy or palatal rugoscopy, the name given to the study of palatal rugae, is a useful method of human identification in these circumstances is by examining the palatal rugae patterns in order to establish a person's identity.[8] According to English et al., the use of palatal rugae was suggested as a method of identification first in 1889 by Allen.[9] Palatal rugae pattern may be specific to racial groups facilitating population identification. The palatal rugae patterns are analyzed in various population and found to be differing among people of different geographical locations and gender.[8]

Method:

The research was a descriptive through observation of the population of the faculty of dentistry Chinese and Indian females students Universitas Padjadjaran using purposive sampling. The sample criteria were:

1. Having bloodline and descendent of at least two generation of Chinese and Indian
2. At age of 16 to 26
3. Not experiencing orthodontic treatment
4. Not wearing partial or full denture.
5. Not having cleft lip and cleft palate.
6. Not having bad oral habit that might impair growth and development of maxilla.
7. Having willingness to participate in the research with informed consent.

According to taroyoname and Slovin formula, it was determined the sample size for Chinese was 30 and 20 for Indians. To confirm the subject's race it was approached through interview under their permission was signed on the approval letter and informed consent. The subject is positioned up-right with occlusal plane parallel to the floor and a brief intra-oral examination is done using mouth mirror to assure that the palatal rugae can be recorded by maxillary impression to have the study model which each were labelled. The intra-oral photo is taken using USB intra-oral camera. The outline of the palatal rugae is delineated on the study model using a sharp black metal ball pen under adequate light and manifying glass x5. The study model is then placed at the center of a piece of plain white A4 size paper. The palatal rugae pattern is analyzed on the study model using magnifying glass x5 and is reanalyzed again after an interval of 10 minutes. The analyzed palatal rugae pattern is recorded according to Martin dos Santos' classification based on the form and position of each palatal rugae are those point, line, curve, angle, circle, sinuous, bifurcated, trifurcated, interrupt, and anomaly.[7] the data obtained is then tabulated.

Result:

There were 239 palatal rugae pattern found based on each maxillary impression taken from 30 Chinese females were analyzed using Martin dos Santos classification. The most prominent form of palatal rugae among Chinese is the curve (41.00%) and less common is interrupt palatal rugae pattern (0.42%), meanwhile there is not found trifurcated form of rugae. The result of the analyzed data is presented in Table 1 below.

Tabel-1. The Palatal Rugae Pattern of Chinese Females

No	Rugae type	Percentage
1	Point	6.28 %
2	Line	23.85 %
3	Curve	41 %
4	Angel	2.93 %
5	Circle	1.67 %
6	Sinuous	15.90 %
7	Bifurcated	5.02 %
8	Trifurcated	0.00 %
9	Interrupted	0.42 %
10	Anomaly	2.93 %

For Indians subjects, there were 163 palatal rugae patterns found based on each maxillary impression were analyzed using Martin dos Santos classification. The most prevalent form of palatal rugae is the sinuous (28.83%), the less common was circle palatal rugae (1.23 %), and there is no interrupted form. The total number of various palatal rugae patterns and their percentages are shown in table 2 below

Tabel-2. The Palatal Rugae Pattern of Indian Females

No	Rugae type	Percentage
1	Point	9.20 %
2	Line	23.93 %
3	Curve	20.25 %
4	Angel	2.45 %
5	Circle	1.23 %
6	Sinuous	28.83 %
7	Bifurcated	7.98 %
8	Trifurcated	1.84 %
9	Interrupted	0.00 %
10	Anomaly	4.29 %

Discusion:

The palatal rugae develops as a result of epithelial proliferation which causes thickening during growth and development intra-uterine before elevation of the palatal shelves. This process is followed by the accumulation of collagen fibers in the connective tissue under the epithelial layer so that a unique orientation will be formed. The orientation of the palatal rugae shape will be achieved in accordance with the formation of the collagen fibers atero-posteriorly in a concentric circle across each rugae base. Hence, prominent rugae will occupy most of the length of the palatal shelves at the time of its elevation in human embryos.[2] The process of palatal rugae formation is influenced by Sonic Hedgehog (SHH) and Transforming Growth Factor β (Tgfβ) so that each population will have different palatal rugae.[10] The position of palatal rugae is also influenced by the post-natal growth of the palate and tooth eruption without changing the qualitative characteristics of the rugae, such as shape, direction and union.[11] The result of this study shows that there are differences in palatal rugae between Chinese and Indian female. This happens because the subjects of this research those are Chinese and Indian female have different races, Chinese females are included in Mongoloid while Indians females are included in the Caucasoid race.[12] meanwhile, the growth and development of the palate, like growth and development of the other part of the body, are infulenced by race and genetic factors. Several previous studies had proven that the palatal rugae pattern in each population is different and this is suspected due to genetic and racial differences.[13] The subjects of this research are the bloodline and descendent of at least two generation.

Previous studies aimed at establishing palatal rugae patterns in aboriginal communities in Australia, Caucasians race, and Japanese society showed that the palatal rugae patterns of the study subjects differed based on gender and side of the palate. The Caucasian group showed wavy pattern was predominant followed by curved and then straight, and the right side of palate showed a significantly more number of straight rugae in males from Madhya Pradesh, whereas wavy pattern was predominant in Keralite males. Selvamani, et al. (2015) found that wavy rugae pattern in 100 Kerala population. The study was conducted by Kapali et al. (1997) on Australian Aborigines and Caucasians had found that the most common shapes in both the ethnic groups were wavy and curved, whereas straight and circular were least common. Shetty and colleagues found that Indian males had more primary rugae on the left side than females and vice versa for the Tibetan population, and Indian males had more curved rugae than Tibetan males. According to this findings, it is proved that racial differences largely determine the rugae patterns.[1,8,14]

Research conducted by Reddy et al (2014) shows that all 10 Chinese subjects show wavy patterns. On the other hand, this study shows that the palatal pattern of the female Chinese rugae, which is curved, differs significantly from the study conducted by Reddy et al. However, this interpretation is hindered by the small sample size and further studies on larger samples are needed to validate the results of Reddy's. The subjects of indian females of this study have sinuous or wavy palatal rugae which is in accordance to Reddy's and Swetha's conducted in the south India confirming that the subject of the research had wavy rugae pattern.[15,16]

Indian females who were the subject of this study have sinuous or wavy palatal rugae in accordance to the results of the research conducted by Reddy (2014) and also Swetha (2015) in South India which confirmed that the research subjects had a wavy rugae pattern. However, this study differs from Reddy and Swetha's study conducted in the North Indian group which found that the study subjects had dominant curved palatal rugae. The difference occur because this study did not take account into indian sub-ethnicities.[15,16] Thus, further study should be carried out considering this issue.

This research does not show any similarity in the combination patterns among the Chinese and Indians females' subject. This result proves that

palatal rugae are highly individualized because no single pair of subject had identical palatal rugae pattern and it has uniquely structure. One of the factors causing the differences in the results of the palatal rugae pattern research is the use of its classification. Hence, it is believed that the end result is different from the previous study in terms of classifying.

Conclusion:

The result of this research has shown that there is a difference between Chinese and Indian females' palatal rugae pattern. The curve rugae form was more prominent in Chinese female followed by line and sinuous rugae form, whereas sinuous rugae form was more prominent in Indian females followed by line and curve rugae.

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