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Research Article

AN IN VIVO STUDY TO COMPARE RELIABILITY OF DERMATOGLYPHICS AND RUGOSCOPY FOR THE PREDICTION OF DIFFERENT CLASSES OF MALOCCLUSION IN NORMAL ADULTS

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A R T I C L E I N F O

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A B S T R A C T

Identification is of cardinal importance in any forensic investigation. In forensic science distinctive traits are used for identifying living or deceased.

INTRODUCTION

Identification is of cardinal importance in any forensic investigation. In forensic science distinctive traits are used for identifying living or deceased. The uniqueness of these patterns and subtle distinction between traits has offered worthy supplemental tools in establishing the true nature of facts. In (1926), Harold Cummins proposed the term "DERMATOGLYPHICS", which originated from two greek words "Dermato" meaningskin and "Glyphics" meaning carving.[1,2]These naturally occurring patterns are unique to an individual and remains the same life long. Even in monozygotic twins the finger-prints are not same, They are unaffected by the environment, which explains their uniqueness and are used asmarker for individual identification and study of specific traits in humans for detection of abnormalities during intrauterine phase and defects in initial weeks of Pregnancy.

Sir Francis Galton classified the basic characteristic pattern of fingerprint, In 1892.

Three types of Fingerprint Patterns[3]: Arches, loops, and whorls. [Figure 1]

The degree of curvature of the ridges decides the type of fingerprint. Arches can be simple or tented, loops can be described as radial or ulnar, and whorls can be spirals or double loop.

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1. Arches: In this type of pattern, the ridges run or flow from one side of the pattern to the other with a slight rise at the center of the pattern without twisting or turning backward
2. Loops: In this type, the ridges start from one side of the pattern, continue till the center, and then at least one ridge turns backward around the core. Depending on the direction, they are classified as radial or ulnar
3. Whorls: In this type, the ridges start from one side of the pattern and complete one complete circle

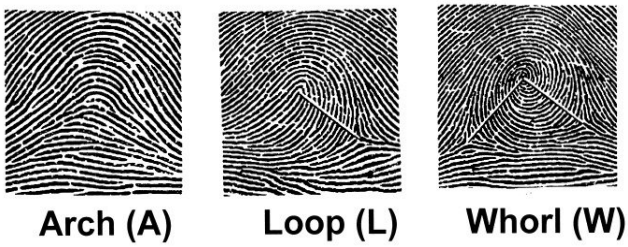


Figure 1

"RUGOSCOPY", is the study of palatal rugae, in order to establish personal identity. Palatal rugae are irregular fibrous connective tissue folds located on anterior third of the palate on either side of mid palatine raphe and are known as plica palatine.[1]They can vary from 4 to 6 in number on each side, and they appear before the fusion of palatines shelves. At the end of intrauterine life, the pattern becomes irregular, anterior ones become prominent and the posterior ones disappear. Palatal Rugae were classified according to their length by

Lysell in 1955[4]vernier calipers was used to record it (least count =0.05 mm) from medial end of rugae to the lateral end.

1. Primary rugaealso known as Main ridges: (5mm or more)
2. Secondaryrugae also known as Secondary ridges: 3-5 mm
3. Fragmentary rugaealso known asridges: less than 3 mm.

We recorded number of rugae on both the sides of the study cast and categorized them under primary, secondary and fragmentary rugae.

Orientation or direction of palatal rugae: First, Second And Third Primary Rugae have different orientation/direction which was recorded separately on both left and right side of each cast where an angle was formed between mid-palatal raphe and Palatal Rugae. [fig 2]Hauser classified them as follows:*1.Posteriorly directed rugae (p)* – analogus with negative angles. *2.Horizontal/perpendicular rugae (h)* - analogus with angles of zero degrees. *3.Anteriorly directed rugae (a)* -ANALOGUS with positive angle.[figure 2]

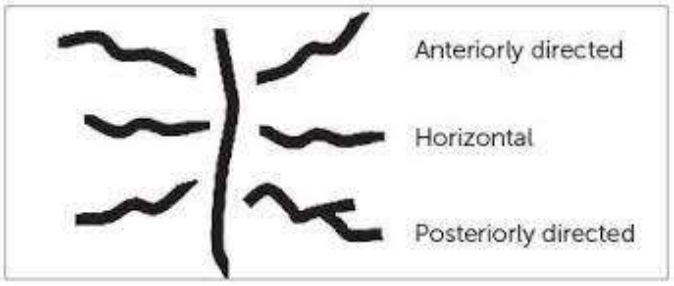


Figure 2

Shape/Pattern of palatal rugae:The shape of first, second and third primary rugae were recorded on both left and right side of each cast using temple tracing from their origin to termination and was classified by Hauser *et al*. as follows:1.*Curved*(c): this type of rugae had a simple crescent shape which curved gently, 2.*Straight(s)*: this type of rugae ran straight directly from their origin to termination., 3.*Wavy (w)*: The basic shape of this type of rugaewas serpentine; however, if there was a slight curve at the origin or termination of curved rugae it was classified as wavy, 4.*Forking (f)*; Fusion occurs when two rugae are joined at their origin or termination based on which, they were of two types : *fd1:Converging*: Rugaeoriginating from different places which joined on their lateral portions. *fd2:Diverging*: fusion in which two rugae began from the same origin but immediately diverged. 1.*Island (i)*: The rugae that displayed a definite continuous ring formation at the termination was termed as Island. 2. *Irregular (Ir)*: Broken, irregular pattern of rugae. [Figure 3]

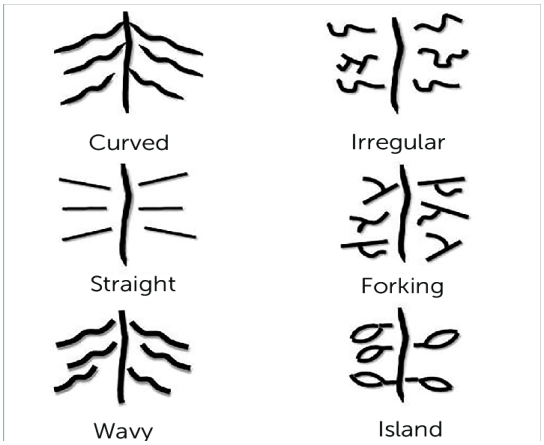
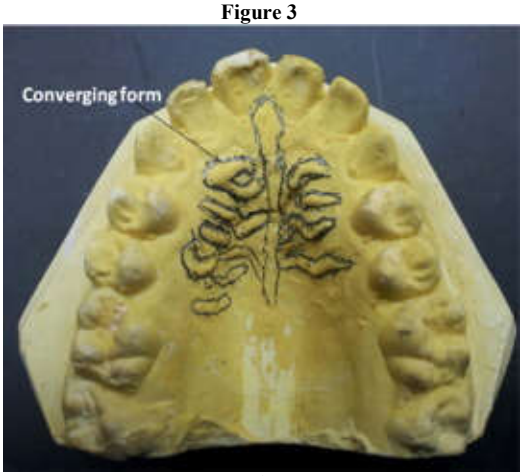
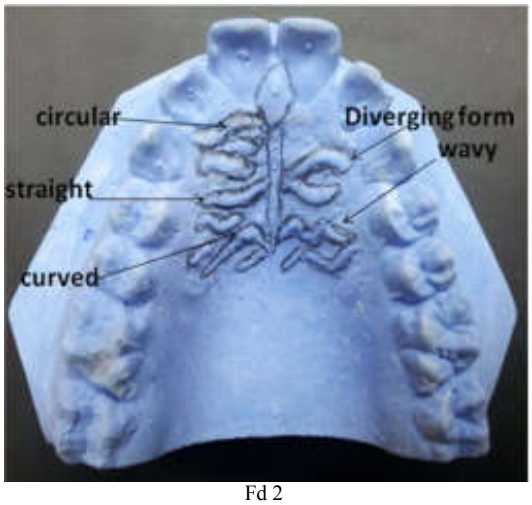


Figure 3



Fd1



Fd 2

Strength of palatal rugae:The strength of first, second and third primary rugae were classified based on their thickness by Hauser *et al*. as follows : a. *Strong(s)*, b. *Medium(m)*, c. *Weak (w)*.The epithelium of finger buds,as well as enamel and rugae have same ectodermal origin therefore dermatoglyphics and palatal rugae can be used as genetic marker

Aim& Objectives of the Study

Aim*:* The aim of this study is to establish the correlation of malocclusion among Dermatoglyphics and Rugoscopy

Objectives

1. Corelation of Dermatoglyphics with different classes of malocclusion

2. Corelation of Rugoscopy with different classes of malocclusion

Hypothesis: There is correlation between palatal rugae pattern and dermatoglyphics pattern to different classes of malocclusion

MATERIALS AND METHODS

Source of Data: The Study was conducted in the department of Orthodontics and Dentofacial Orthopaedics in Dental College Azamgarh, Uttar Pradesh, India. All the patient who reported to the department fulfilling the criteria in the duration of 1 month were considered.

Consent: Details of procedure were explained to patients and informed consent was obtained prior to the study.

PilotStudy:A Pilot Study Was Done.

Sample selection Criteria

In the time period of 1 month we got 18 patients who were fulfilling our inclusion and exclusion criteria and they were considered as sample size in present research

Inclusion Criteria

- All permanent teeth present in both the arches (excluding third molars).
- Subject with sound mental and physical health
- No history of orthodontic treatment in either arch.
- No large restorations in coronal part that might have altered both coronal shape and size.
- Non – fractured teeth

Exclusion Criteria

- Patient with a history of trauma or surgical procedures done in orofacial region were not included.
- Patients in mixed dentition phase were not included.
- Special children

MATERIALS

1. Gloves.
2. Mask
3. Mouth mirror
4. Impression trays.
5. Alginate impression material
6. Dental stone.
7. Fingerprint bioscanner.
8. Magnifying lens
9. VernierCallipers

Figure 4

Fig 5 Digital Bioscanner

Fig 6 Digital Vernier Calliper

METHODOLOGY

For recording the fingerprints, the hands of the subjects were cleaned with spirit. [5] Proper sterilization protocols were followed. The impression of individual digits was made by placing the bulb of the digit onto the surface of the bioscanner. (Mantra MFS100 v54). The impression of remaining digits of both right and left hand were made in a similar manner, which was further classified in patterns accordingly by using Magnifying glass.

Figure 7

Fig 8 Results Obtained

For recording the molar relation and rugae, alginate impressions of both the maxillary and mandibular arch were

made after following the proper covid 19 protocols and study models were prepared.

On the study models, the molar relation was determined according to

Angle's classification of malocclusion

1. Angle's Class I, 2. Angle's Class II (Angle's Class II Division 1 & Angle's Class II Division I),3. Angle's Class III [figure 9]

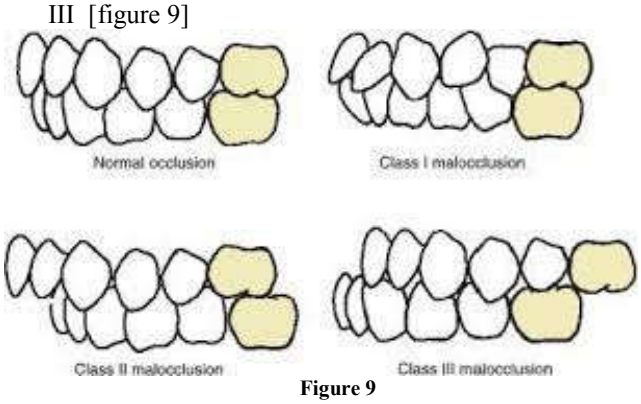


Figure 9

The relation of fingerprints and palatal rugae pattern was studied with the molar relation recorded using the study models.

Statistical Analysis & Result

- The statistical analysis was performed by using statistical tests.
- Chi square test was performed
- Software used was SPSS 21
- p value is set at ≤ 0.05
- Test resultwere significant for comparison of malocclusion with palatal rugae pattern.
- Test result were non significant for comparison of malocclusion with dermatoglyphics pattern.

Table 1 Correlation of rugae pattern with different types of malocclusion

Rugae Pattern	Primary Irregular	Primary Wavy	Primary Forking	Primary Curved	p-value	S/NS
Class 1	0(5.6%)	4(22.2%)	3(16.7%)	1(5.6%)	0.050	S
Class 2	3(16.7%)	7(38.9 %)	0(0%)	0(0%)		

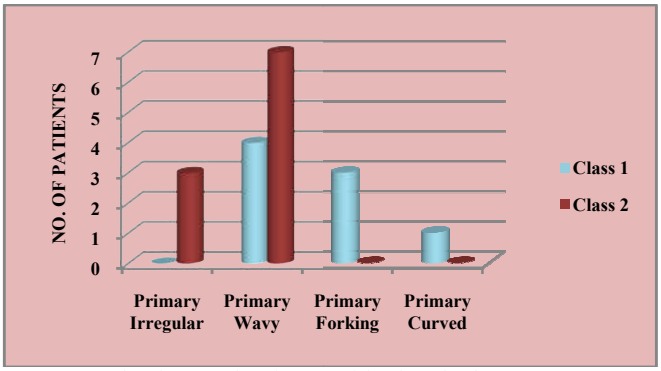
(p ≤ 0.05 – Significant, CI = 95 %)

Table 2 Correlation of Finger Print Pattern with different types of malocclusion

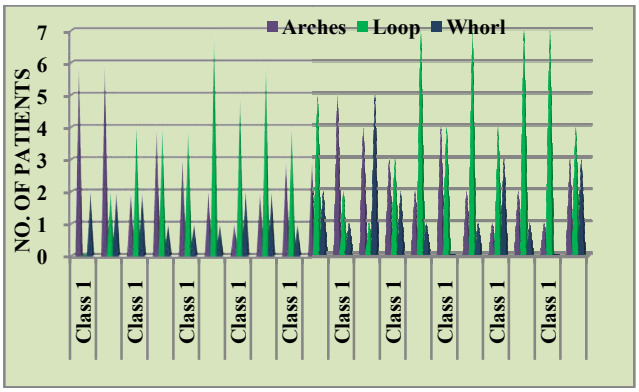
Finger Print Pattern		Arches	Loop	Whorl	p-value	S/NS
Right Thumb	Class 1	6(33.3%)	0(0%)	2(11.1%)	0.407	NS
	Class 2	6(33.3%)	2(11.1%)	2(11.1%)		
Right Index	Class 1	2(11.1%)	4(22.2%)	2(11.1%)	0.799	NS
	Class 2	4(22.2%)	4(22.2%)	1(11.1%)		
Right Middle	Class 1	3(16.7%)	4(16.7%)	1(5.6%)	0.668	NS
	Class 2	2(11.1%)	7(38.9%)	1(5.6%)		
Right Ring	Class 1	1(5.6%)	5(27.8%)	2(11.1%)	0.903	NS
	Class 2	2(11.1%)	6(33.3%)	2(11.1%)		
Right Little	Class 1	3(16.7%)	4(22.2%)	1(5.6%)	0.894	NS
	Class 2	3(16.7%)	5(27.8%)	2(11.1%)		
Left Thumb	Class 1	5(27.8%)	2(11.1%)	1(5.6%)	0.232	NS
	Class 2	4(22.2%)	1(5.6%)	5(27.8%)		
Left Index	Class 1	3(16.7%)	3(16.7%)	2(11.1%)	0.380	NS
	Class 2	2(11.1%)	7(38.9%)	1(5.6%)		
Left Middle	Class 1	4(22.2%)	4(22.2%)	0(0%)	0.318	NS
	Class 2	2(11.1%)	7(38.9%)	1(5.6%)		
Left Ring	Class 1	1(5.6%)	4(22.2%)	3(16.7%)	0.377	NS
	Class 2	2(11.1%)	7(38.9%)	1(5.6%)		
Left Little	Class 1	1(5.6%)	7(38.9%)	0(0%)	0.098	NS
	Class 2	3(16.7%)	4(22.2%)	3(16.7%)		

(p ≤ 0.05 – Significant, CI = 95 %)

GRAPHS



Graph 1 Showing Results of Comparision in Palatal Rugae Pattern To Different Class of Malocclusion



Graph 2 Showing Results of Comparision in Dermatoglyphics Pattern To Different Class of Malocclusion

DISCUSSION

This study has been performed in the department of orthodontics and dentofacialorthopaedics in Dental College Azamgarh In this study patient samples were collected after informed consent and the data of dermatoglyphics pattern and palatal rugae pattern were compared to different classes of malocclusion.The study concluded that there was a significant corelation when palatal rugae patterns had been compared with the different classes of malocclusion as the study which was conducted by lalitya D., *et al* in the year 2019[13][Table 1] while on other hand it also concluded that there was no significant correlation during comparision of dermatoglyphics pattern to the different classes of malocclusion [Table 2] which was similar to the study conducted by Kaur H., *et al* in the year 2020[9]. Graph 1 and Graph 2 shows the diagrammatic representation of the results.

In (1982) Kharbanda O., *et al*.[7] stated that (A) The craniofacial skeletal class III pattern (Mandibular Prognathism) is associated with:1. Increase in arches and ulnar loops at the expense of whorls on all digits except digit two. Increased frequency of whorls and radial loops.3. Increased frequency of carpel loops in seen on third inter digital 3 area of palms. (B) The mandibular prognathism is autosomal in inheritence and not sex linked. (C) A further exhaustive study with more specific case selection criteria avoiding ethnic andracial variations is greatly warranted.

Mossey P. in (1999)[11]concluded that there is considerable evidence suggesting that genes play a significant role in the aetiology of many dental anomalies.

Bhasin M., *et al*in (2016)[8].; did the study and evaluated that Dermatoglyphics can serve as an easy, accessible, inexpensive and non-invasive method of exploring the genetic associations of malocclusion and for timely prevention, however, it cannot be relied upon as the sole factor.

Cheeli S., *et al in*2017[1] on the basis of her study examined that Based on shape, curved pattern of palatal rugae can be considered as non-invasive predictor for Group 1B (Class II) and Group 1C (Class III). Among gender distribution, females displayed curved pattern of palatal rugae in Group 2B (caries active). No specific predominant dactyloscopic pattern was observed in both Groups 1 and 2. Rugoscopy, a non-invasive method, can help in early diagnosis for devising a preventive approach through genetic counseling.

Fatima F., *et al*. In (2018)[6]: concluded that there is an association between the number of palatal rugae and the pattern of primary rugae with the Angle's classes of malocclusion. However, the length and the orientation of the primary palatal rugae showed variable results.

CONCLUSION

Dermatoglyphics is a Forthcoming Area of interest. Its use as an indicator for various conditions is still in its initial stages. From the previous mentioned studies, it can be said that there is an association between various malocclusions and different dermatoglyphic patterns. However, whether dermatoglyphics alone can be considered as a factor to diagnose malocclusion is still questionable. Extensive studies with larger sample size of various ethnic origin and racial backgrounds are required to establish this. If dermatoglyphics are proven to be an acceptable diagnostic tool, it can help in identifying malocclusion at an early age and thus help in preventive and interceptive treatment.[3]Similarly, Rugoscopy, a non-invasive method, can help in early diagnosis for devising a preventive approach through genetic counseling. [14]

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