An assessment of correlation between fingerprint and malocclusion in a sample of Erbil city

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Abstract: Background and Objective: Dermatoglyphics has been shown to be useful in predicting orofacial abnormalities. The objective of this study was to explore if there is any link between fingerprints patterns and malocclusion type among a sample of Erbil city.

Method: In this cross-sectional study, A total of 1000 finger prints were taken from 100 participants that were students, patients, and staffs of college of dentistry at Hawler Medical University. Age group was from 18 to 30. The fingerprints were recorded to analyze the type of pattern by digitalized finger scanner. Occlusion status was clinically assessed using Angle's classification of malocclusion.

Results: The Angle's Class I malocclusion was the most common type of malocclusion among the study participants, according to the data in this study. The most predominant fingerprint was loop pattern and the least pattern was arch. All three types of fingerprints were mostly found in participants with Angle's Class I malocclusion. There was no significant difference between types of finger print patterns in all ten hand fingers and malocclusions.

Conclusion: in all 10 fingers of both hands, there was no correlation between any patterns of fingerprints and malocclusions.

Key words: Dermatoglyphics, Fingerprints, Angle's Classification, Malocclusion.

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Introduction

World Health Organization described malocclusion as a handicapping anomaly, refers to nonstandard occlusion and/or disturbed craniofacial relationships, which may also have an effect on esthetic appearance, function, facial harmony, and psychosocial comfort. [1, 2] It is one of the most communal dental problems, with excessive occurrence starting from 20% to 100% stated by dissimilar researchers.[3-5] Dermatoglyphics is the study on fingerprints and skin patterns, is probably the eldest of all sciences, as its importance was apparent millions of years ago.[6] "Dermatoglyphics", as defined by Cummins and Midlo, [7] refers to the study of the complex composition of the dermal ridge of the skin covering the surface of the soles and soles of the feet and hands.

The unique fingerprint pattern can be regarded as a genetic marker of dental disease as both tooth enamel and finger bud epithelium are derived from the ectoderm and both are formed at the same time in intrauterine life.[8]

Dermal ridges development begins between 12th and 13th weeks of gestation and by around 20th week, well differentiated identifiable dermal ridges are formed.[9] Genetic or chromosomal abnormalities can be reflected as changes in dermal ridges, they can be used as an simply accessible tool in the study of genetically affected diseases.[10]

Dermatoglyphic testing is convenient, inexpensive and does not require hospitalization. This helps to predict the phenotype of a possible future health condition. [11]

In humans, tooth development begins at the 6th week of embryonic life. [12] Meanwhile

both dermic patterns and craniofacial composition are powerfully but not exclusively genetically governed structures, it may be hypothesized that hereditary and genetic factors causing changes in the lip, alveolus and palate can also cause peculiarities in fingerprint patterns.[13]

Fingerprints are usually categorized into three basic groups (Fig.1) namely whorls, arches and loops.[14] Loops: Ridges curve around only on furthest end and flow to the brink of the finger. Depending upon the side brink on which the loop opens, it is named ulnar loop or radial loop.

Arches: Ridges runs from one side to another with distally inclined wave. Whorls: Homocentric design with most ridges making orbit around the core.[13] An individual can have the same pattern on all ten fingers but various patterns often occur on different digits. [15]

It has been shown that in medical dermatoglyphics there is an connotation between fingerprint patterns and several conditions like breast cancer [16] diabetes mellitus, hypertension, [17]psychosis, [18] epilepsy, [19] congenital heart diseases [20] alcohol embryopathy [21] and many other conditions. [22] In the field of dentistry, [8, 23] irregular fingerprints have been observed among patients with dental caries,[8, 23] certain types of congenital anomalies like cleft lip and palate, [24] periodontitis [25] and lately, dermatoglyphics has been linked to malocclusion. [13]

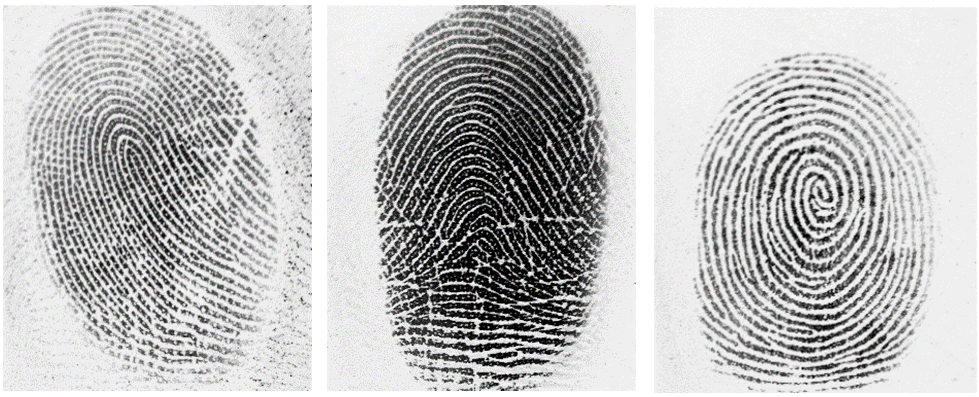
Researches have stated different outcomes of dermatoglyphic form in persons with dissimilar malocclusion sort in different states. [6, 26] Hence, this research was conducted to find the dermatoglyphic pattern and the type of malocclusion among people visiting Hawler Medical University. This research also tries to establish connotation of different types of malocclusions with dermatoglyphic pattern.

Methods

This cross-sectional study was conducted among a sample of Erbil city from college of dentistry at Hawler medical university, after obtaining ethical approval 1000 finger prints was recorded from 100 participants with their molar Angle's classification of dental students, staffs and patients between the age of 18-30 years, from 1st of December 2021 to 7th March of 2022, Convenience sampling technique was used for selecting the participants. informed written consent form signed by participants before recording finger prints and oral examination.

Inclusion criteria: All permanent teeth must be present excluding third molar, all 10 fingers should be present without any deformity and scars.

Exclusion criteria: Participants with previous orthodontic treatment, participants with previous orthognathic surgery, participants with previous maxillofacial trauma, participants who has crowns and bridges that affect the molar classification, cleft lip and palate participants, participants with congenital or acquired deformities of their fingers, participants with amputated fingers, participants with skin disease or wound and scars on their fingers.



A B C

Figure 1: A: Loop, B: Arch and C: Whorl.

For assessing types of malocclusions and recording finger prints, the examiner asked the participants to sit on dental chair facing the light, after explaining the study and taking informed consent from the participants examiner started to ask the participants questions according to the exclusion and inclusion criterias, their ages and work, then starting the intra oral examination for assessing molar Angle's classification, grouped into Class I, Class II, and Class III malocclusion [27].

Fingers of participants cleaned with alcohol wipes to make them free from any oils, grease, dirt and powders, then dried with dried tissue, after that fingerprints of both the hands were recorded by portable digitalized scanner (Fig.2) which was connected to the laptop by universal serial bus USB, In case of unsatisfactory prints the procedure was repeated, for each participant we opened a file on the laptop and numbered the file from 1 to 100 that each number represent a participant, each file contains recorded finger prints of all 10 fingers of right and left hand, with age, gender and types of malocclusions.

The fingertip patterns were analyzed according to the classical method and configurational types (28). The impressions were assessed for fingerprint pattern such as arch, whorl and loop patterns. Arch pattern is composed of ridges which pass across the finger with slight bow distally with no triradii. The shape of whorl pattern area may be either circular or elliptical and have two triradii. The loop pattern possesses only one triradius. Twist site of ridges is called head of the loop. From the opposite extremity of the pattern, the ridges flow to the margin of digits. The reading checked three times, inter and intraexaminer collaboration done by examiner and other examiner, Kappa test performed to make sure of accuracy of readings. The researcher, intra and inter examiners totally (100%) agreed on all the variables in all situations, so Kappa test was equal to one in all the conditions. Finally, the data were entered in a Statistical Package for the Social Sciences (SPSS) version 26 software and then subjected to statistical analysis. Proportion, percentage for dermatoglyphic patterns and malocclusion were calculated. Chi-square test was done to find out the association of dermatoglyphic pattern with malocclusion with significance level set at $P < 0.05$.

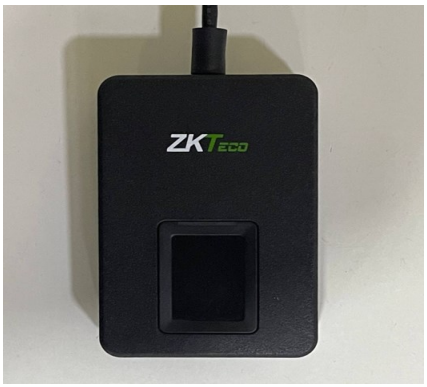


Figure 2: Portable digitalized fingerprint scanner

Result

In this study individuals were examined for their Angle's molar classification and pattern of finger print. 51 (51%) of participants were male and 49 (49%) were female. The mean age of them was 23 years. Most of the participants 59 (59%) were diagnosed for Angle's class I molar classifications. 21(21%) were class II and 20(20%) were class III. For finger print patterns, 478 of 1000 finger prints were loop which was the most common type (47.8%), and then followed by Whorl 421 (42.1%), and Arch 101 (10.1%).

Frequency distribution of finger print patterns according to malocclusion are shown in (Table 1). Loop pattern was most commonly seen in the right little finger of participants having Angle's Class I malocclusion. Whorl pattern was seen more in the right ring finger of individuals with Angle's Class I and arch pattern was seen more in left middle finger in participants with Angle's Class I malocclusion.

There was no significant difference between finger print patterns and malocclusions in all

ten hand fingers, whether finger print patterns were Loop, Whorl or Arch the participant most commonly had Angle's Class I malocclusion. For example in right thumb finger all types of finger prints mostly found in class I malocclusions with the order of loop, whorl and arch respectively from highest number to lowest (Table 2).
In class II and class III malocclusions whorl pattern was the most dominant pattern. Arch pattern was the least type of finger print in class I and class II but there was no arch pattern in class III malocclusions. There was no significant difference between all three finger print patterns and molar Angle's classifications in right thumb finger.

Table 1: Frequency distribution of finger print patterns according to malocclusion

Type of pattern	Malocclusion (Angle's classification)	Thumb		Index		Middle		Ring		Little	
		Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Loop	**class I**	31	30	22	26	32	29	23	23	42	40
	class II	9	9	6	5	13	11	5	6	13	17
	class III	9	9	5	5	8	11	7	6	12	14
Whorl	**class I**	25	26	25	21	16	17	33	31	12	15
	class II	11	10	10	12	7	6	16	15	8	4
	class III	11	11	12	12	9	5	13	14	8	6
Arch	**class I**	3	3	12	12	11	13	3	5	5	4
	class II	1	2	5	4	1	4	0	0	0	0
	class III	0	0	3	3	3	4	0	0	0	0

Table 2: Association between Angle's classifications and finger print patterns in right thumb

		Angle's classification			Total
		class I	class II	class III	
Right thumb	Loop	31	9	9	49
		63.3%	18.4%	18.4%	100.0%
	whorl	25	11	11	47
		53.2%	23.4%	23.4%	100.0%
	Arch	3	1	0	4
		75.0%	25.0%	0.0%	100.0%
Total		59	21	20	100
		59.0%	21.0%	20.0%	100.0%

p:0.796

Discussion

The interplay and synergistic impacts of genetic and environmental factors leads to development of malocclusion. The impact of a given environmental influence on phenotypic varies based on genetic background, which in turn impacts facial and dental morphology. [29]

In the present study, most of the individuals had Angle's Class I malocclusion, followed by Class II and Class III malocclusion which is almost similar to the finding of another study done in college of dentistry of Hawler Medical University[30] and in other countries like Saudi Arabia, Nepal and Nigeria. [31-33] The dermatoglyphic pattern mostly seen in the study sample was loop followed by whorl and arch type. This finding is respectively comparable with other studies among individuals residing in Sri Lanka, Nigeria, India, Nepal, Kenya and Tanzania and Malaysia. [33-40] And present findings are disagreeing with the results of studies in New Zealand, Egypt, China and India which whorl pattern was the most common pattern in their study while in our study loop is the most common pattern [41-46] and this disagreeing maybe because of the limited sample size in this present study. According to a review, The frequency distributions of different finger patterns (in percentages) can be generalized among major population groupings in the following order: Whorls: Mongoloids > American Indians > Europeans > Africans; Loops: Africans > Europeans > American Indians > Mongoloids; Arches: Africans > American Indians > Europeans > Mongoloids. [47]

In the current study, loop pattern was most commonly seen in the right little finger of participants having Angle's Class I malocclusion. Whorl pattern was seen more in the right ring finger of individuals with Angle's Class I and arch pattern was seen commonly in left middle finger in participants with Class I malocclusion. However, a study done in Nepal by Poudel P et al, loop pattern was most commonly seen in the right middle finger of participants having Angle's Class II malocclusion which was disagree with our results. Whorl pattern was seen more in the right ring finger of individuals with Angle's Class I and that's the same with our results that agree with, and arch pattern was seen commonly in left index finger in participants with Class I malocclusion. [48] Nevertheless, a study done in India by Shetty et al, Angle's Class I malocclusion was seen in individuals with whorl ridge pattern in their left thumb, whereas Class III malocclusion was most frequently seen in individuals with loop ridge pattern in their left thumb. [49] Two studies done in India by Reddy et al and Deepti et al observed more loop patterns in right little finger in participants with Angle's Class II malocclusion. [6, 47]

In the present study, there was no significant association between finger print pattern and malocclusion in all ten hand fingers. This finding was in contrast to the studies done in India by Tikare et al, by Deepti et al, and in Nepal by Poudel P et al. [13, 48, 50]

Conclusion

The Angle's Class I malocclusion was the most common type of malocclusion among the study participants, according to the data that we collected. The most predominant fingerprint was loop pattern and the least pattern was arch. All three types of fingerprints were mostly found in participants with Angle's Class I malocclusion. There was no significant difference between types of finger print patterns in all ten hand fingers and malocclusions.

Conflict of interest

The author reported no conflict of interests.

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