

Comparison and Association of Dermatoglyphics and Dental Anomalies in Three Different Regional Populations of India: An Original Study

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Abstract

Aim: The purpose of our study was to investigate and find the association of dental anomalies with the dermatoglyphic pattern within three regional populations of India. **Methods:** The present study included 600 subjects. 200 from each population were selected randomly and examined for dental anomalies and their dermatoglyphic patterns were recorded. **Statistical Analysis Used:** The study was analyzed by a chi-square test. **Results:** One dental anomaly was consistently noted in all three populations. Out of 600 subjects, 40.8% had positional anomalies. Shoveling, congenitally missing teeth, and winging were seen significantly in North-Eastern (23.0%), Jammu & Kashmir (5%), and Western Uttar Pradesh (6%) population groups in order. The most common dermatoglyphic pattern seen in all three populations was an ulnar loop. Significant relation between shoveling and whorl pattern was seen in the North-Eastern population. The presence of rotation was significantly more among subjects with a whorl pattern. **Conclusion:** The study concluded that dermatoglyphics can be used as an indicator of few dental anomalies. It can help in identifying the gender, race of an unidentified person, and various diseases which are correlated with dental anomalies that can be detected earlier.

Keywords: Arch, Dental Anomalies, Dermatoglyphics, Rotation, Shoveling, Ulnar loop, Whorl

1. Introduction

India is home to various races which integrated and settled here and became an integral part of the Indian population. The evolution of modern Indian civilization has multiracial contributions. So, different populations in India show diverse morphologic features¹.

North East India is the land of co-existence of the extreme forms of both tradition and modernity. Ethnically the tribes of the North East belong to the Indo Mongloid race².

Indo Aryans constituted the majority population in Uttar Pradesh who were believed to have migrated from Central Asia. Other populations like jaats and Gujar are descendants of Indo Aryan and Indo Scythian tribes³.

The population of Jammu & Kashmir is complex in the sense that it's composed of various ethnic groups that have their regions of high and low concentrations. This population has ancestral roots with Indo Greeks⁴.

These three regional populations are influenced by different races and can show the difference in morphology of teeth and dermatoglyphic traits.

Any developmental disturbance which results in abnormal color, shape, size, and the number of teeth will lead to the formation of dental anomalies. It has a multifactorial etiology⁵.

The study of palms has evolved from a mere depiction of the future to the point where its association with various diseases has been found. Various studies showing the association of Dental caries, periodontitis, cleft lip

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and palate, and dermatoglyphics have been done in the recent past⁶.

The aim of this study was to evaluate the presence of various dental anomalies and dermatoglyphics in three different regional populations of India and to determine any correlation between them.

2. Materials and Methods

After explaining the procedure of the study to the subjects, informed consent was obtained. Oral examination was done to find any dental anomaly. Subjects were asked to rinse their mouth with water and sit in an upright position. After tray selection, 40 ml of water was added to the rubber bowl with the help of a measuring cylinder. This was followed by the addition of two scoops of alginate. Alginate was mixed rapidly with a curved spatula in a figure of eight. The tray was positioned in the center of the jaw. After 30 seconds, the impression was removed with a firm, quick snap. Within 30 minutes, an impression was filled with the dental stone and was allowed to set for about half an hour to obtain maximum strength.

For obtaining dermatoglyphic prints, sweat, oil, and dirt were removed from the patient's hands by washing hands with soap and water. Then patients were advised to apply stamp ink uniformly over their fingers using an ink pad. Fingers were kept straight and the hands were at the level with the wrist. Prints were taken on the paper kept on the table by applying uniform pressure on all fingers. After the satisfactory prints were obtained, patients were advised to rub their hands with sterillium followed by washing with soap and water. The armamentarium used in the study is shown in Figure 1.

Then the association and correlation between dental anomalies and dermatoglyphic patterns were established using the chi-square test and results were tabulated.

3. Results

The present study was designed to compare and evaluate dental anomalies and dermatoglyphics in three different regional populations of India i.e., North Eastern, Western Uttar Pradesh, and Jammu & Kashmir. Two hundred subjects from each population were selected randomly and examined for dental anomalies. Dermatoglyphic prints of the same subjects were also recorded by using the



Figure 1. Armamentarium used in the study.

ink pad method. The statistical analysis used in the study was the chi-square test. The study comprised 206 males and 394 females. 304 patients with a prevalence of 50.7% had at least one anomaly. The most commonly detected anomaly in all the three populations was Rotation with a prevalence of 59.0%, 55.0%, and 63.5% in North Eastern, Western U.P, and J&K populations respectively. Shoveling was seen most commonly in the North East population (23.0%). Gemination was present only in the North-Eastern population with a prevalence of 2%. Congenitally missing teeth was detected most commonly in the Jammu and Kashmir population with a prevalence of 5%. Winging was seen most commonly in the Uttar Pradesh population with a prevalence of 12%.

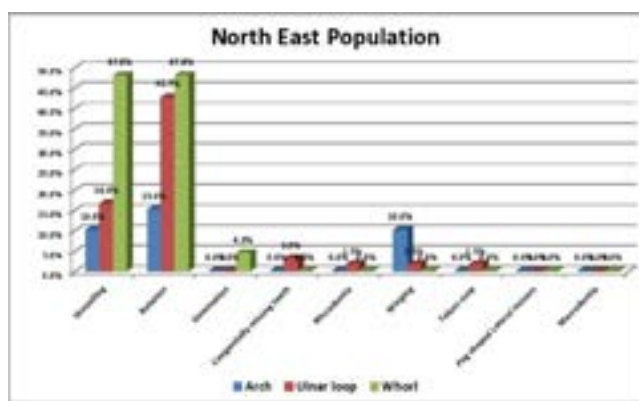
In our study, the Correlation of dental anomalies and dermatoglyphics in three different populations was done. 22 subjects exhibiting ulnar loop (16.4%), 22 subjects exhibiting whorl pattern (47.8%) and 2% subjects with arch (10.0%) had shoveling. Although the number of individuals with ulnar loop and whorl pattern was the same, the prevalence of subjects with whorl pattern exhibiting shoveling was more. Among North East population shoveling and whorl pattern depicted a significant relationship.

Rotation was also compared with different dermatoglyphic patterns. The presence of rotation was significantly more among subjects with a whorl pattern. Thus in our study, ulnar loop patterns were seen more commonly associated with rotation. A significant relationship ($P < 0.05$) was being established.

Table 1. Association of dental anomalies and dermatoglyphics in North East population

	North East Population			Chi-square value	p-value
	Arch	Ulnar loop	Whorl		
Shovelling	2	22	22	21.195	< 0.001*
	10.0%	16.4%	47.8%		
Rotation	3	57	22	6.606	0.037
	15.0%	42.5%	47.8%		
Gemination	0	0	2	6.763	0.034
	0.0%	0.0%	4.3%		
Congenitally missing teeth	0	4	0	2.010	0.366
Microdontia	0	2	0	.995	0.608
	0.0%	1.5%	0.0%		
Winging	2	2	0	7.645	0.022
	10.0%	1.5%	0.0%		
Talons cusp	0	2	0	.995	0.608
	0.0%	1.5%	0.0%		
Peg shaped Lateral incisors	0	0	0	0.000	1.000
	0.0%	0.0%	0.0%		
Macrodontia	0	0	0	0.000	1.000
	0.0%	0.0%	0.0%		

Chi-square test *Significant difference



Graph 1. Showing association of dental anomalies and dermatoglyphics among North Eastern population.

4. Discussion

Dental anomalies are unique features and can show an inclination towards any particular population or gender and can provide an important source for phylogenetic and

genetic studies important for both the anthropological and clinical management of patients⁷.

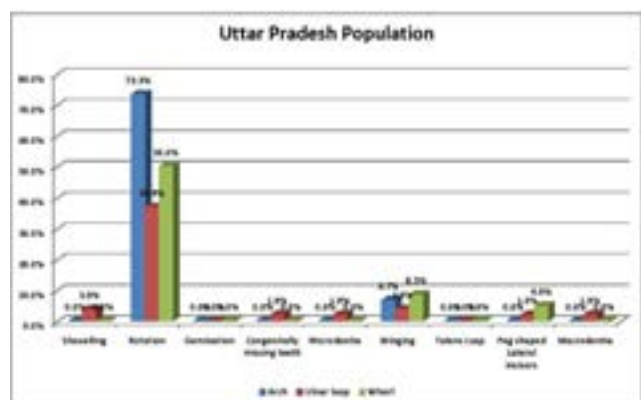
Dermatoglyphics are standard features of personal identification, so by establishing the correlation of dental anomalies with dermatoglyphics, it may help in predicting the forthcoming dental anomalies in a child through its fingerprints⁸.

Among all developmental dental anomalies, rotations are the most commonly encountered anomalies. Both the disturbances before and after eruption can act as an etiological factor. Gupta S.K *et al.* in 2011 and Kathariya M.D in 2013 in their study found out that rotations were present in 10.24% and 13.2% subjects respectively^{9,10}. In our study, the most commonly encountered anomaly was Rotation. The prevalence of rotation was 41.0% in the North East population, 45.0% in Western Uttar Pradesh Population, and 36.5% in Jammu & Kashmir population. No difference in the presence of rotation in North East, Western Uttar Pradesh, and Jammu and Kashmir

Table 2. Association of dental anomalies and dermatoglyphics in Western Uttar Pradesh population

	Western UP Population			Chi-square value	p-value
	Arch	Ulnar loop	Whorl		
Shovelling	0	4	0	3.844	0.146
	0.0%	3.9%	0.0%		
Rotation	11	38	41	8.429	0.015*
	73.3%	36.9%	50.0%		
Gemination	0	0	0	0.000	1.000
	0.0%	0.0%	0.0%		
Congenitally missing	0	2	0	1.903	0.386
	0.0%	1.9%	0.0%		
Microdontia	0	2	0	1.903	0.386
	0.0%	1.9%	0.0%		
Winging	1	4	7	1.765	0.414
	6.7%	3.9%	8.5%		
Talons cusp	0	0	0	0.000	1.000
	0.0%	0.0%	0.0%		
Peg shaped Lateral incisors	0	2	4	1.854	0.396
	0.0%	1.9%	4.9%		
Macrodontia	0	2	0	1.903	0.386
	0.0%	1.9%	0.0%		

Chi-square test *Significant difference



Graph 2. Showing Association of dental anomalies and dermatoglyphics in Western Uttar Pradesh population.

population. Though there was a slightly higher prevalence of Rotation among the Uttar Pradesh population.

Gupta S.K in 2011, Yassin SM in 2016, and Vani VN *et al.*, in 2016 reported that rotation was seen in 10.68% males and 9.78% females, 12 males and 8 females, 22.8% males and 17.6% females^{9,11,12}. These studies indicated a slightly higher male incidence. In our study, the presence

of rotation was more in females i.e., 44.4% as compared to 34.0% in males. The reason for this diversity can be multifactorial etiologies of rotation and due to more female participants (Table 1).

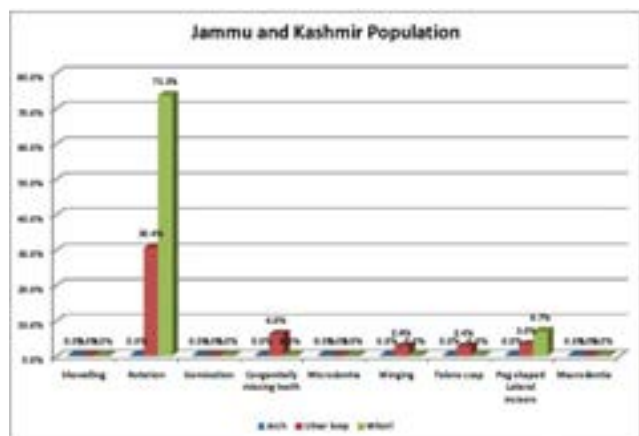
Shoveling was noted considerably in Mongoloid groups, including north-eastern Indians, Bunun aborigines, Chinese, and Eskimos. A study carried out by Canger E.M *et al.*, in 2014 and Uthaman C *et al.*, in the year 2015 and Nagraj T *et al.*, in 2015 revealed that shoveling was seen in 10.1%, 40%, and 85% in Turkis, Tibetians, and Western Indian populations respectively¹³⁻¹⁵. In the current study, shoveling accounted for 8.3% of the subjects. It was seen in 23.0% North East population and 2% population in Western Uttar Pradesh subjects. Shoveling was not seen in any subject of the J&K population. The shoveling was found to be significantly more among North East populations in comparison to Western Uttar Pradesh and Jammu and Kashmir populations.

Congenitally Missing is believed to be the most common developmental anomaly of human dentition seen in 25% of the population, the third molar being most affected of them (20.7%). The racial predilection of

Table 3. Association of dental anomalies and dermatoglyphics in Jammu & Kashmir population

	Jammu and Kashmir Population			Chi-square value	p-value
	Arch	Ulnar loop	Whorl		
Shovelling	0	0	0	0.000	1.000
	0.0%	0.0%	0.0%		
Rotation	0	51	22	21.445	< 0.001*
	0.0%	30.4%	73.3%		
Gemination	0	0	0	0.000	1.000
	0.0%	0.0%	0.0%		
Congenitally missing	0	10	0	2.005	0.367
	0.0%	6.0%	0.0%		
Microdontia	0	0	0	0.000	1.000
	0.0%	0.0%	0.0%		
Winging	0	4	0	0.777	0.678
	0.0%	2.4%	0.0%		
Talons cusp	0	4	0	0.777	0.678
	0.0%	2.4%	0.0%		
Peg shaped Lateral Incisors	0	5	2	1.100	0.577
	0.0%	3.0%	6.7%		
Macrodontia	0	0	0	0.000	1.000
	0.0%	0.0%	0.0%		

Chi-square test *Significant difference



Graph 3. Showing Association of dental anomalies and dermatoglyphics in Jammu & Kashmir population.

tooth agenesis is also seen. Asians show increased tooth agenesis as compared to Whites, while Blacks have the least cases of tooth agenesis. Patel S *et al.*, in 2013, Afify A.R *et al.*, in 2012, Vahid-Dastjerdi *et al.*, in 2010, Gomes *et al.*, in 2010, Uslu *et al.*, in 2009, Endo in 2006 and Fnaish in 2011 reported the prevalence of congenitally missing teeth as 4.19%, 21.2%, 9.1%, 6.3%, 21.6%, 8.5%,

8.83% respectively¹⁶⁻¹⁹. In the current study, congenitally missing teeth were seen in 2.7% of subjects. Jammu and Kashmir populations exhibited 5% congenitally missing teeth followed by the North East population (2%) and the Uttar Pradesh population (1%). The Congenitally missing teeth were found to be significantly more among Jammu and Kashmir population in comparison to North East and Western Uttar Pradesh population.

Sheikh M *et al.*, in 2012, Silva *et al.*, in 2003, Chung *et al.*, in Korea, and Behr *et al.*, observed that congenitally missing teeth were equally distributed in males and females^{20,21}. Polder *et al.*, in 2004, concluded that congenitally missing teeth were more commonly encountered in females²². In our study, the comparison of the prevalence of congenitally missing teeth was done between males and females, there was no noted difference in the prevalence of congenitally missing teeth between males and females though the presence of congenitally missing teeth was slightly more among females than males.

Numerous studies related to dermatoglyphics have been recorded over the last century in many countries around the world. The following studies are in accordance

with our study. Nithin *et al.*, in 2009, Gangadhar *et al.*, 1993, Tamgire DW *et al.*, in 2013 reported that the prevalence of ulnar loop was 52.3%, 57.11%, and 59.2% respectively²³⁻²⁵. Jaga *et al.*, in 2008 in subjects of South Nigeria. Igbigi *et al.*, in the population of Kenya and Tanzania and by Eboh in Anioma and Urhobo population in Soth Nigeria where dermatoglyphic patterns noted were in order of Ulnar loop, Whorl, and arch in order^{26,27}. Bansal D H in 2014 mentioned that ulnar loops to be the most common pattern reported in Marathi subjects of Nagpur city²⁸.

The present study is not in concurrence with the following studies. Ching Cho reported in their study the incidence of whorls (60.6%) followed by the ulnar loop (38.65%). Banik *et al.* did a study on Rengma Nagas of Nagaland. Other studies which reported the prevalence of whorls more than loops were reported by Biswas *et al.*, Tiwari *et al.*, Ghosh *et al.*,^{29,30}.

In the current study (2017), dermatoglyphic patterns in the North-Eastern population showed 10% arch pattern, 67% ulnar loop, and 23% whorl pattern. Ulnar loop pattern was found to be the most common pattern seen. Western Uttar Pradesh population showed 7.5% arch pattern, 51.5% ulnar loop pattern and 41.0% whorl pattern. In Jammu and Kashmir population Arch patterns are present in 1% population, Ulnar loop in 84%, and whorl in 15% population. Among all these three populations, Ulnar loop is the most common dermatoglyphic pattern and whorl is the second most common among all the three population groups (Table 2). Our study is in accordance with the following studies. Khadri S in 2013, Deopa Deepa, Joshi S, Kapoor N and Badiye A in 2015, Yohannes S and Bekele E in 2015 Wijerathne BTB *et al.*, in 2013 Srivastava Namouchi among Tunisians, Qazi *et al.*, Boroffice among Nigerians reported that the most common pattern was loop followed by whorl and arch^{31,32}.

There are sparse reports of dermatoglyphic findings in children with dental anomalies, and only two studies have been reported regarding the same. In one study done by Maheshwari N *et al.*, in 2013 loops were the dominant pattern seen in the control group while dental anomalies were mostly seen in cleft patients (50%)³³.

In 2016 Narang D *et al.*, designed a study to make an observation of the usefulness of dermatoglyphic patterns in serving as a predictor for impacted teeth in population and to analyze fingerprint patterns in people with impacted teeth and compare them with people without impacted teeth³⁴. They observed that loop pattern was

observed slightly lower in the control group than that of Impacted Teeth group.

Apart from this, various studies of the association of dermatoglyphics and malocclusion are present in the literature. However, those studies are confined to the association of classes of malocclusion and fingerprints. In our study, we compared the dental anomalies with dermatoglyphics in three different populations. Correlation of dental anomalies and dermatoglyphics in three different populations was done. 22 subjects exhibiting ulnar loop (16.4%), 22 subjects exhibiting whorl pattern (47.8%) and 2% subjects with arch (10.0%) had shoveling. Although the number of individuals with ulnar loop and whorl pattern was the same but the prevalence of subjects with whorl pattern exhibiting shoveling was more. There was significant relation in the prevalence of shoveling and whorl pattern in the North Eastern Population.

Rotation was also compared with different dermatoglyphic patterns. The presence of rotation was significantly more among subjects with a whorl pattern. Thus in our study, ulnar loop patterns were seen more commonly associated with rotation. A significant relationship was being established. This shows as a marker for each one's identification as well as to know the developmental anomalies or the defects in utero during the early stages of pregnancy itself. Therefore, both genetic and environment are to be considered as important factors in this aspect.

The present study was conducted to check the reliability of dermatoglyphics as a predictive diagnostic tool for dental anomalies in order to apply preventive and interceptive treatments to the high-risk groups. So according to our study, whorl and arch pattern can be associated with shoveling and rotation. An increased number of whorls in a child can be indicative of shoveling and rotation respectively.

Both dermatoglyphics and dental anomalies have both obvious polygenic and environmental influences and both develop at similar time periods. So any deviation or abnormality in one can be manifested in other. Dermatoglyphics which were used earlier in forensic science for human identification has new scope for early detection of various dental and medical diseases, which needs early detection to prevent progression.

Dental anomalies do not occur in every individual so they can act as a source of identification during mass destruction or unveil the identity of a person from teeth in cases where only teeth have remained.

Dermatoglyphics can act as an indicator of dental anomaly which a child will develop in his later life and can be corrected earlier. It can help in the pre-diagnosis of dental anomalies. This study aims to bring forth useful data regarding the prevalence of the most common dental anomalies and dermatoglyphic patterns among three different regional populations of India.

5. Conclusion

Slight physical abnormalities are seen in the general population, which do not hamper day to day life of an individual and no treatment is required for those Odontogenic anomalies which are multifactorial including genetic, traumatic, and environmental etiology. Both dermatoglyphics and dental anomalies have obvious polygenic and environmental influences and both develop at similar time periods. So any deviation or abnormality in one can be manifested in other. Recent researches in the study of dermatoglyphics patterns are extremely helpful in the diagnosis of various medical conditions. Studies for utilizing dermatoglyphics and dental disease have also been reported. Dermatoglyphics can also act as an indicator of dental anomaly which a child will develop in his later life and can be corrected earlier. It can help in the pre-diagnosis of dental anomalies. The present study was undertaken for knowing any relation between dental anomalies and dermatoglyphics among three different regional populations of India.

In the end, I would like to conclude that if other populations of India can be studied for dental anomalies and dermatoglyphics, we can obtain data for the same to help to identify the race/region of a person in the identification of the individual. Studies with a larger sample size can be conducted to enhance the available data regarding the prevalence of the most common dental anomalies and dermatoglyphics in the particular region.

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