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Research Article

Comparative evaluation of dermatoglyphic pattern in children with or without congenital agenesis of permanent mandibular incisors

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Abstract:

Background:
Dermatoglyphics can be used as a potential adjunctive diagnostic tool in the identification of various orofacial and dental anomalies like congenital agenesis of teeth.

Aim:
To evaluate the correlation between dermatoglyphic pattern with congenital agenesis of permanent mandibular incisors in non-syndromic patients.

Materials and Methods:
Dermatoglyphic patterns were recorded using Cummins and Midlo method among 35 patients. Age of the patients ranged from 8-14 years. Correlation between fingerprint patterns and congenital agenesis of permanent mandibular incisors was recorded and subjected to statistical analysis using bi variable test and independent t test.

Results:
The arch pattern was highly significant with number greater for the study group as compared to the control group. Following the independent test, there was no statically significant difference in the distribution of the patterns between females and males was observed.

Conclusion:
Dermatoglyphics can be used as a valuable tool in diagnosing congenital tooth agenesis pertaining to permanent mandibular incisors.

Key words: congenital agenesis of incisors: ermatoglyphics: hypodontia: mandibular incisors: permanent incisors

Introduction:

The palmar and plantar surfaces of man is not smooth but is grooved by curious ridges, which form a variety of configurations and, it is these ridge configurations that have attracted the attention of laymen for ages.[1] The study of these dermal ridge counts and figures on the fingers, palms, and soles is called dermatoglyphics,[2] which was coined by Harold Cummins in 1926,[3] derived from two Greek words – *derma referring to* skin and *glyphe* referring to carve.[4] The finger and palm prints start forming during the 6-7th week of the embryonic period and are completed by 10-20 weeks of gestation.[3] The genesis of the dermal ridges occurs with relation to the volar pads. The dermal ridge appears during the 12th week of the intrauterine life and are completed by the 24th week of intrauterine life which is the period the same time as that of tooth formation in intrauterine life. This conveys that the genetic coding contained in the genome, normal or abnormal, is decoded during this stage and could also be replicated by dermatoglyphics. The ectoderm, from which the epidermis is derived, plays an important role

in the configuration of several structures such as the teeth. If an intrauterine dermal damage take place, a tooth anomaly might be expected. [3,4] Fingerprints are unique to all individuals and remain unchanged throughout the life. They are determined by various genes.[5] Over the past 150 years, dermatoglyphics has been a powerful tool in understanding the basic questions in biology, medicine, genetics and evolution, in addition to being one of the most widely used method for personal identification. [6,7] However, it is still at infancy in dentistry where the co-relation of dental conditions and dermatoglyphic patterns is done.[7] Congenital agenesis of teeth is the anomaly involving tooth number characterised by agenesis of single tooth, more than one tooth, many teeth or complete set of teeth in non-syndromic patients. The scientific names mentioned in the literature are hypodontia, oligodontia and anodontia.[8] Among this congenital agenesis of permanent mandibular incisors including both central and lateral incisors is commonly observable finding in some races.[8-12] The author of this paper reported few case series showing congenital agenesis of permanent mandibular incisors in Indian population.[13] However, there are no enough studies done in the scientific literature to show the prevalence of congenital agenesis of permanent mandibular incisors in non-syndromic patients among different population. Literature shows several studies on dermatoglyphics and their relation to dental caries, malocclusions and other dental conditions. [7,14-20] However, to the best of author's knowledge there have been no study relating the dermatoglyphics and congenitally missing permanent mandibular incisors behind which any genetic influence exists. Therefore, the present study had been undertaken to correlate the dermatoglyphics pattern and congenital agenesis of permanent mandibular incisors among South Indian population.

Materials and methods:

A total sample size of 36 children aged 8 to 14 years who reported to Dental wing, Karnataka ENT Hospital and Research Centre, Chitradurga, Karnataka**,** India, were included in the study. The experimental group included 21 children of age 8 to 14 years with at least one permanent mandibular incisors tooth that was congenitally missing. While the control group included 15 children that had a perfect dentition. Patients selected for both groups were healthy and syndromic conditions or systemic disorders were ruled out before commencement of the study. Written consent was obtained from the parents before the procedure was carried out. For evaluation of congenital agenesis of tooth first on clinical examination if any retained primary mandibular incisor is present or missing permanent incisors were examined thoroughly and then subjected to radiographic examination for confirmation of congenital agenesis of permanent mandibular incisors.

Dermatoglyphic recording and interpretation:

The Cummins and Midlo ink method was used to record the finger and palm prints.[7] Before the impressions were taken, the hands of the included children were washed thoroughly with water and soap to remove any oil and dust.

Fingerprints recording:

Blue duplicating ink was used to record the fingerprints of all children. The finger prints were pressed over the blue stamp pad and then firmly placed over the white bond paper clipped against the board. The fingerprints were observed in a sequential manner under a magnifying glass with ×2 power, from the left-hand 4th digit until the thumb followed by the thumb of right hand until the 4th digit. Dermatoglyphic analysis included the qualitative analysis of the fingertip patterns.

Result:

The study was conducted with a total sample size of 36 children aged 8 to 14 years. The experimental group included 21 children of age 8 to 14 years with at least one permanent mandibular incisor tooth that was congenitally missing. While the control group included 15 children that had a prefect dentition with all incisors present. Children age 8-14 years were included in the study with the mean age of 11.05 for the study group and 8.93 for the control group (Table 1). The bi variable test carried out for the gender-wise distribution among the groups showed 63.9% males and 36.2% females (Table 2). Following the independent t test, the result showed that except the arch pattern none of the groups showed any significant differences. The arch pattern was highly significant with number greater for the experimental group as compared to the control group (Table 3). Following the independent t test, there was no statically significant difference in the distribution of the patterns between females and males (Table 4).

Table 1: Distribution of groups with age

Group	N	Mean Age
Experimental	21	11.05
Control	15	8.93

Table 2: Gender-wise distribution of study groups

		Sex		
		Male	Female	Total
Group	Experimental	12	9	21
		57.1%	42.9%	100.0%
	Control	11	4	15
		73.3%	26.7%	100.0%
Total		23	13	36
		63.9%	36.1%	100.0%

Table 3: Dermatoglyphic pattern among study groups

	Group	N	Mean	Std. Deviation	t-value	p-value
WHORL	Experimental	21	3.62	2.711	1.303	0.201
	Control	15	2.53	2.066		
LOOP	Experimental	21	4.81	2.400	0.640	0.526
	Control	15	4.33	1.877		
ARCH	Experimental	21	1.67	1.390	-2.691	0.010
	Control	15	3.13	1.885		

Table 4: Gender-wise distribution of dermatoglyphic pattern between study groups

	Sex	N	Mean	Std. Deviation	t-value	p-value
WHORL	Male	23	3.30	2.566	0.436	0.665
	Female	13	2.92	2.431		
LOOP	Male	23	4.87	2.096	0.944	0.352
	Female	13	4.15	2.340		
ARCH	Male	23	1.91	1.379	-1.708	0.097
	Female	13	2.92	2.178		

Discussion:

Dermatoglyphic patterns can be helpful for genetic studies, because unlike stature, intelligence, and body weight, they are not significantly influenced by age or by postnatal environmental factors.[5] It has the advantage of remaining stable throughout life and therefore can be compared among individuals of different ages.[21] A good print makes a permanent and complete record providing both qualitative and quantitative data.[4] Widespread interest in epidermal ridges developed only in the last several decades when it became apparent that many patients with dental abnormalities had unusual ridge formations. [6,22,23]

Since time immemorial the characteristics of the hands has fascinated scholars, sages, theologians, doctors and layman in a similar manner. Through decades of scientific research, the hand has been recognized as an authoritative tool in the diagnosis of psychological, medical and genetic conditions. Dermatoglyphics reflects the study of epidermal ridges and their patterns they make on the fingers, palms and soles. [1,4,21]Literature search revealed different investigations on dermatoglyphics and have proved that dermatoglyphics helps for detecting intrauterine anomalies and identifying diseases like type I diabetes mellitus, breast carcinoma and also helps in preventing diseases.[1] The hypothetical concept behind the relation between variations in dermatoglyphics and numerous diseases and or syndromes is that, morphogenesis of epidermal ridges and organogenesis occurs at the same period during embryogenesis and programmed by genetic expressions which are related to each other. [2-4,24] During the 6-7th week of intra-uterine life, dermal ridges develop from fetal volar pads. This is the period which corresponds to the same period as that of tooth formation in embryo. The genetic message both normal or abnormal present in the genome is transferred during this intrauterine life period and it is reflected in both teeth and dermal ridges.[4] Therefore, these dermatoglyphic patterns are unique for each individual and they remain same once formed without changing in the pattern.[1,4] Based on this concept, they are widely used as biometric analyzer for identification of persons and also used for recognizing particular diseases or syndromes in preventive medicine.[1]Grew was the first scientist who studied dermatoglyphics in 1684. It denotes permanent imprint patterns of epidermal ridges on palmar and plantar surfaces of hands and feet respectively. In India from ancient times the ridge pattern study was popularly known as "Samudra Shastra.' In this shastra the imprints of hands and feet were classified into "chakra, shankya, and padma" corresponding with the whorl, loop and arch patterns of current scientific classification. Later in 1923, Parkinjee categorized epidermal ridge patterns into nine types.[25] Gradually numerous investigations were carried out to correlate dermatoglyphic variations between normal individuals and patients with chromosomal aberration like trisomy 18, trisomy 13, trisomy 8 and 21.[6,26-28] Dermatoglyphic pattern has been studied in evaluating its association in dental caries,[3,7,20] congenital defects like cleft lip and cleft palate,[2,17] periodontal diseases, bruxism, malocclusion[15,16,18,19,23,24,29] and oral submucous fibrosis.[16] Kharbanda et al[18] and Sharma et al[19] found correlation of dermatoglyphics in mandibular prognathism and retrognathism cases. Prevalence of congenital agenesis of permanent mandibular incisors has been rarely studied in the dental literature. [9-12] Revathi and Varghese in 2022[10] evaluated the incidence of congenital missing mandibular incisors among 962 Indian patients. The prevalence of missing lower incisors was observed in 16 patients (8.38%) and the mandibular left central incisor was the most commonly missing tooth (50%) followed by right central incisor, left lateral incisor and right lateral incisor. Gender wise comparison showed higher incidence of missing incisors in females compared to males.[10] Other studies reported prevalence of 8.1% in German population and about 0.3% in Jewish population and 10.1% among Norwegian population. [11,12] The wide range of results obtained from the above studies may be due to different factors like age,

gender, sampling methods and clinical evaluation performed in these studies. [30]

Literature shows sparse reports of dermatoglyphic findings in children with dental anomalies. Maheshwari et al in 2013[31] evaluated dermatoglyphic traits correlation with dental anomalies in patients with and without cleft lip/palate patients. Maximum difference (50%) was found with hypodontia anomaly in cleft patients with loop pattern being dominantly seen in the control group. [31] Later Kour et al in 2021 [32] evaluated association of dermatoglyphics and dental anomalies in three different regional populations of India. In their investigation among 600 subjects, 40.8% had positional anomalies. Congenitally missing teeth, winging and shoveling were significantly seen in Jammu and Kashmir (5%), western Uttar Pradesh (6%) and North-Eastern (23%) areas. Among North-Eastern population significant relation between shoveling and whorl pattern was noticed. Ulnar loop was the most common dermatoglyphic pattern observed in all three populations [8]. In this study, congenitally missing teeth were seen among 2.7% of subjects. But they have not clearly indicated which teeth were congenitally missing. Among Jammu and Kashmir people, 5% congenitally missing teeth was observed followed by 2% in North East population and 1% in Uttar Pradesh population. The final concluding point observed from this study was that 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. Other anomalies evaluated in this study were shoveling, rotation, gemination, microdontia, winging, talon cusp, peg shaped lateral incisors and macrodontia. The present research is the first study which evaluated the relation between dermatoglyphic pattern and congenital missing of permanent mandibular incisors among Indian normal population in contrast to Maheshwari et al study who evaluated in cleft lip and palate patients.[31] The results of the present study showed that only arch pattern was significant in patients with congenital agenesis of mandibular incisors as compared to group without agenesis. Whereas another Indian study showed dominance of loop pattern in cleft lip and palate patients with hypodontia. [31] In the current study, no significant difference was noticed between males and females with respect to dermatoglyphic pattern in both the groups evaluated. This finding was in accordance with other studies. [31] In Kaur et al study, [32] congenitally missing teeth were seen in 2.7% of subjects. However, they did not find significant 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. In studies done by Sheikh et al [33] and Behr et al, [34] congenitally missing teeth were equally distributed in males and females. Whereas Polder et al [35] reported that congenitally missing teeth were more commonly encountered in females. Revathi and Varghese [10] found higher incidence of congenital agenesis of lower incisors among females (6.54%) as compared to males (4.59%) in their study. The same finding was observed in other studies like UK and Malaysian study. [36-40] A study conducted on UK population, Iceland population and on Malaysian population showed higher prevalence rates of hypodontia in females in contrast to males. [36-40] The higher prevalence noticed in the above studies might be due to the associated biological factors like smaller jaws which might trigger environmental factors.[41] This factor was confirmed by the fact that teeth might get missing if the development of tooth germs is delayed and thereby the required space has been compromised by the surrounding tissues.[10]

Conclusion:

From this investigation it was concluded that, there is a strong corelation between dermatoglyphic pattern with congenital agenesis of permanent mandibular incisors. Therefore, dermatoglyphic can be used as an adjunctive valuable diagnostic tool to predict the agenesis of incisors in human population.

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