Variations of Dermatoglyphic Patterns among Smoking and Smokeless Forms of Tobacco in Oral Potentially Malignant Disorders and Oral Cancer- A Review of Literature

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Abstract

Dermatoglyphics is a scientific study which involves the study of fingerprints.lines ,mounts and shapes of hands.This dermatoglyphics origin dates back to ancient India, were this ridge pattern study was known as "Samuda Sashtra.These dermatoglyphic patterns are usually genetically determined.In dentistry, dermatoglyphics have been applied for identifying syndromic cases and also been useful for determining caries susceptibility,identification of cleft lip and cleft palate. Here the variations of dermatoglyphic patterns among smoking and smokeless forms of tobacco in oral potentially malignant disorders and oral carcinoma has been reviewed.

Keywords *: Dermatoglyphics, Fingerprints, Genetics, Oral Potentially Malignant Disorders*

Introduction

Dermatoglyphics is a scientific study which involves the study of fingerprints, lines, mounts and shapes of hands.[1] The history and origin of dermatoglyphics dates back to 1823 with the work of Jan Evangelista Purkyne who had first studied the papillary ridges of hands and feet.[2] Sir Edward Henry in 1893 published a book on "The classification and uses of fingerprints" which gave way to the basis of fingerprint identification and other related systems.[3]

The term " dermatoglyphics" was first coined by Cummins and Midlo in 1926 and it is derived from the Greek wherein 'derma' means skin and 'glyph' means carving.[4] The fingerprints are always unique for an individual as they are genetically determined with a polygenic pattern of inheritance.[5]

Dermatoglyphic analysis may help in personal growth as in strengthening the interpersonal communication and interaction skills, it can also enhance the emotional quotient(EQ) and adversity quotient (AQ).[6]

Dermatoglyphics in identification of genetic abnormalities

Dermatoglyphics have also been associated with various genetic abnormalities which can be useful in the diagnosis of congenital malformations.In case of Klinefelter syndrome, there is excess of arches on the first digit, increased frequency of ulnar loops in the second digit, overall there are fewer whorls and lower ridge counts for loops and whorls and significant reduction of the total finger ridge count.[7] In Noonan's syndrome,there is increased frequency of whorls on the fingertips and the axial triradius.[8] In turner's syndrome, there is increased incidence of single transverse palmar crease and predominantly they have whorl patterns.[9] In people with congenital blindness,they have an increased frequency of triradius.[10] In individuals affected with Down's syndrome, they have increased ulnar loops and a distinct angle between the triradia a,t and d('atd' angle).[11]

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In Rubinstein Taybi syndrome, individuals manifest with broad thumbs, low mean ridge count and fingerprint patterns in interdigital areas.[12] In schizophrenia, the A-B ridge counts are lower compared to normal healthy individuals.In pseudohypoparathyroidism, there are short broad bands, high axial triradius and increased arch patterns.[13]

Methods of dermatoglyphic analysis

The dermatoglyphic analysis procedure including collection of fingerprints, palmprints and foot prints. There are various methods of recording dermatoglyphics which includes the ink method, Faurot inkless method, transparent adhesive tape method, photographic method and other special methods.[14]

The ink method is the most commonly used method and first begins with the application of ink (normally Kore's duplicating ink is used) on the fingers and palms and stamped on a sheet of paper with firm , uniform pressure. The prints are then scanned into a computer software database and then the prints are analysed.The genetic sequence is then analysed. Based on the existing databases, the fingerprints are identified.[15]

In Faurot inkless method, they use commercially available solutions with a specially treated sensitised paper.[16]

Transparent adhesive tape method involves the application of a dry colouring pigment to the skin and lifting it off with a transparent adhesive tape.[17]

Photographic method involves principles of total internal reflection which occurs when an object is pressed against a prism.The magnified image is photographed by a polaroid camera.[18]

Dermatoglyphics in Oral Potentially Malignant Disorders and Oral Cancer

Oral Potentially Malignant Disorders (PMD) include a variety of lesions and conditions characterised by an increased risk of malignant transformation to oral squamous cell carcinoma. A study by David and Sinha on dermatoglyphic patterns in subjects with potentially malignant disorders and oral carcinoma revealed that the mean number of loops and the mean total ridge count were found to be higher in case of subjects with potentially malignant disorders and oral carcinoma when compared with controls. In patients with oral cancer, arches were more predominant.[19]

In a study done by Lakshmana et al. in 2016 on the role of digital and palmar dermatoglyphics in early detection of oral leukoplakia, oral submucous fibrosis and oral squamous cell carcinoma patients, it was found that loops were found to be the predominant finger ridge patterns in these patients with oral leukoplakia whereas whorl pattern was found in controls.[20]

In a cross sectional study done by Aditya et al. in 2016 on the analysis of fingerprints pattern in patients with potentially malignant disorders, they found that in patients with preleukoplakia, oral leukoplakia and OSMF there was an increased frequency of arches and loops whereas in the control group, the whorls and loops were more frequently seen.($P=0.05$).[21]

A cross-sectional study by Shetty et al. in 2016 on dermatoglyphics as a genetic marker for oral submucous fibrosis , it was found that percentage of whorls in study groups was 24 % and 20% in the right and left hand respectively as compared to 7 % and 5% in controls group. The percentage of arches in the study group was 0 % and 1% in the right and left hand as compared to the 8 % and 7% in the control group. ($P<0.05$).These results indicate that dermatoglyphics can be used to determine the genetic susceptibility of individuals to develop oral submucous fibrosis.[22]

Gupta and Karjodkar et al. in their study on the role of dermatoglyphics as an indicator of precancer and cancerous lesions of the oral cavity in 120 individuals who were divided into four groups ; where Group 1 consisted of 30 male patients with history of tobacco/ areca nut intake with occurrence of oral squamous cell carcinoma, Group 2 had 30 male patients with history of tobacco/areca nut intake with occurrence of oral submucous fibrosis, Group 3 included 30 males with habit of tobacco/areca nut without any evidence of oral lesions while Group 4 had 30 males without any habit and oral lesions which were the control group. Overall, there was a significant increase in the arch and loop pattern frequency.[23]

A dermatoglyphic study was done by Ganvir et al. in 2014 on the detection of genetic predisposition in OSCC and OSMF patients by qualitative analysis of finger and palm-print patterns .So in their study , they had mentioned that a predominance of whorl type fingerprint pattern can be used as a screening marker for identifying the susceptibility of OSMF and OSCC.[24]

A qualitative and quantitative analysis of palmar dermatoglyphics among smokeless tobacco users by Vijayaraghavan and Aswath in 2015 was a prospective comparative study among 40 patients (Group 1- 10 samples of smokeless tobacco users with OSMF, Group II-10 samples of smokeless tobacco users with OSCC, Group III- had 10 samples without smokeless tobacco and Group IV-had 10 samples without smokeless tobacco habit without OSMF and OSCC and they were the control group). They found that there was a predominance of arches and loops configurations , presence of hypothenar pattern, decrease in the mean ATD angle($P<0.001$) and total AB ridge count ($P=0.005$) in OSMF and OSCC patients.[25]

Vinothini et al. in 2017 did a cross sectional study to evaluate the relation between palmar dermatoglyphics with OSCC and OSMF patients. They had included 15 individuals with OSMF, 15 individuals with OSCC and 15 individuals were controls with no habits or lesions. They found that loops were frequent among the cases, whereas whorl patterns were common among the controls ($P<0.05$).Loops were also common in the interdigital areas than in control ($P<0.05$).[26]

A dermatoglyphics study by Dutta et al. in 2016 on the comparison of finger print patterns in patients with and without oral submucous fibrosis.In their cross-sectional study they had included 30 subjects with history of gutkha chewing of 10 years wherein 15 patients had developed OSMF and 15 patients without OSMF .They found a decrease in arches pattern, radial loop pattern , whorl pattern and atd angle in patients with OSMF. The results were statistically significant in individuals with ulnar patterns ($P<0.05$).[27]

In a study to assess palmar dermatoglyphics in oral leukoplakia and oral squamous cell carcinoma patients by Venkatesh in 2006, where they comprised of 30 subjects with oral leukoplakia and 30 individuals with habits and no lesions as controls.Arches and loops were more frequent in cases than in controls whereas whorls were more frequent in control group ($P<0.01$).The loop pattern were at a higher frequency in the interdigital areas in cases than in controls .($P<0.05$).[28]

In a study by Munishwar et al. in 2015 on the qualitative analysis of dermatoglyphics in oral submucous fibrosis, 25 subjects were gutkha chewers with OSMF,25 were gutkha chewers without OSMF and 25 subjects were healthy controls. There was significant increase in the percentage of loops among gutkha chewers with OSMF and controls and increase in the whorl patterns among control group.Among the digits ,there was increase in the whorl pattern in the right index and right ring finger.($P=0.0328$ and $P=0.0368$ respectively).[29]

A study by Patil et al. in 2017 on dermatoglyphics in oral potentially malignant disorders and oral cancer revealed that among the dermatoglyphic patterns, 60.66% of patients with potentially malignant disorders and 46 % of the oral cancer patients had whorl patterns. There was also a significant decrease in the mean accessory tri-radii digital angle(37.13 degrees).[30]

In a cross sectional study done by Singh et al. in 2016 where the fingerprints and palm prints were studied in 180 patients who were randomly divided into three groups : Group A consisted of 60 subjects with oral leukoplakia, OSMF and OSCC, Group B consisted of 60 patients with habits but no lesions, Group C consisted of 60 healthy controls. The arch pattern was the predominant pattern (60.7%) with a decrease in the whorl pattern (29.3 %) in group A when compared with the controls (group B and C)($P<0.01$).There was an increase in the mean total finger ridge count($P<0.675$).[31]

Variations of dermatoglyphic patterns among smoking and smokeless forms of tobacco in OPMDs and oral cancer

In general, there are many studies which state that the nicotine content is higher in the smoking form of tobacco like bidis, cigarettes in comparison to the smokeless form of tobacco which includes pan,gutkha chewing. In one such study by Amit et al. in 2018 where they had evaluated the nicotine content in smoking and smokeless forms of tobacco, they found that bidis had the highest content of nicotine, followed by chewed tobacco (pan masalas) and cigarettes.With increasing nicotine content, literature states that there is an increased malignant transformation risk of these OPMDs.[32]

In a study by Gandham and Thajuddeen in 2018 wherein they had compared the dermatoglyphic patterns in 250 alcohol and/or tobacco smokers with 250 non consumers, they found a decrease in 'ATD' angle in both hands of male ($P<0.001$) and female ($P<0.001$) cases as compared to the controls. The percentage of ulnar loops ($p=0.020$), arches($p=0.010$) and composite patterns ($p=0.005$) were less among males compared to male controls, the percentage of whorls was more

among males compared to male controls (P<0.001),the percentage of radial loops was more among the female cases group in comparison with the female controls (P=0.017).[33]

Conclusion

Dermatoglyphics analysis play a very important role in identifying the susceptibility of an individual to a particular syndrome, disease or certain other disorders as it is based on the genetic makeup of an individual. This scientific study was mainly used in the branch of criminology for solving various crimes .In dentistry, now this scientific study has been gaining importance and is been mainly used for identification of syndromes as most of them are genetically inherited, useful in determining the susceptibility of an individual to dental caries, periodontal diseases, cleft lip and palate, OPMDs and oral cancer. More studies have to be conducted for bringing this dermatoglyphics method as routine identification systems in the future perspective.

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