Original Research Paper

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Assessment of Palmar Patterns and Dermatoglyphics in Oral Cancer Patients of Bareilly City: An Observational Study.

Abstract:

Background and objectives: Dermatoglyphics are the dermal ridge configuration on the digits, palms and soles. Dermatoglyphics may be used as an easily accessible tool in the study of genetically induced diseases as genetic or chromosomal defects may be expressed as alterations in dermal ridges. They are genetically determined and influenced by environmental forces that are operating before birth. Several studies have shown association between dermatoglyphics and different types of cancer. Hence this study was undertaken to determine whether specific dermatoglyphic patterns exist which help in predicting the occurrence of oral squamous cell carcinoma.

Aim: This study was conducted to study palmar and dermatoglyphic patterns in oral carcinomas patients in Bareilly city.

Material and method: Our study was conducted among 59 subjects having oral cancer in Bareilly city. A modified case history proforma and comprehensive history was taken. Finger and palm prints were collected from Oral squamous cell carcinoma (OSCC) patients using digital method and were evaluated qualitatively and quantitatively using appropriate statistical test.

Results: Finger and palm prints were evaluated qualitatively and quantitatively. Significant findings in patients with oral squamous cell carcinoma in both hands were: Increased in frequency of Loops and whorls, Loop patterns are common in Thenar/I 1 area, Increased Total finger ridge count on right hand, increased ab count on left hand, more atd angle on left hand.

Conclusion: Our study concluded that dermatoglyphic patterns may have a role in identifying individuals either with or at risk for developing oral squamous cell carcinoma. It can be used to identify high risk group, so that early primary and secondary preventive measures can be instituted in order to prevent the occurrence of these lesions.

Key-words: Oral Squamous Cell Carcinoma, Dermatoglyphics, Preventive measures

Introduction:

Dermatoglyphics is a relatively new science that involves studying digits, palms, and soles with fine patterned dermal ridges. The term Dermatoglyphics (derma = skin; glyphics = carvings), for the scientific study of ridges, was coined by Cummins and Midlo (1926). The widespread interest in epidermal ridges develops when it became apparent that many patients with chromosomal aberrations had unusual ridge formations. In patients with single-gene disorders and in some people in whom the genetic basis of the disorder is unclear, unusual ridge configurations have been shown to exist.[1] In determining the genetic susceptibility of high-risk individuals to the development of oral squamous cell carcinoma,

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dermatoglyphic patterns are a promising diagnostic method. [2] They may be used as an easily accessible tool in the study of genetically induced diseases as genetic or chromosomal defects may be expressed as alterations in dermal ridges. [3,4]

Oral squamous cell carcinoma is one of the high malignant potential oral lesions and a proportion of cases of oral cancer due to oral squamous cell carcinoma ranges between 17% and 35%. [5] The prevalence of oral cancer has been gradually rising in recent years and is now ranked fifth in terms of cancer burden globally. In India, oral cancer ranks first among all cancers in men and as number three among cancers in women. [6] Oral cancer is a multifactorial disorder that occurs in a variety of chromosomes and genes due to molecular aberrations. As a result, certain individuals who are exposed to carcinogens with genetic instability have a higher chance of developing these lesions. [7]

Since epidermal ridge patterns form early in foetal growth and remain unchanged throughout life 8,9 irregular dermatoglyphics can indicate gene or chromosomal abnormalities associated with oral carcinomas. In this study, we have assessed the finger and palmer patterns using a digital scanner among well stabilized oral cancer patients and analyzed the patterns, so that individuals with high risk may be detected at the earliest. Hence, this study was conducted to study palmar and dermatoglyphic patterns in oral carcinomas patients in Bareilly city.

Aim and Objectives of study:

The aim of this research is to assess the Palmar and Dermatoglyphic patterns in oral cancer patients of Bareilly city.

The objectives of this study are:

1. To identify oral cancer patients based on confirmatory biopsy report.
2. To study palmar patterns using digital palm scanner.
3. To study fingerprint features using digital finger print scanner.

Materials and method:

A cross-sectional questionnaire study was conducted amongst undergraduate dental students in Dental College located in Bareilly, Uttar Pradesh, India for a period of one year (November 2018 to October 2019).

Voluntary informed consent was obtained, and the questionnaires were given at the individual level. Prior to commence of the study, an ethical clearance was obtained from the Institutional Ethical Committee of Institute of Dental Sciences, Bareilly

The present study was performed in the Institute of Dental Sciences and Rohilkhand Medical College and Hospital, and Keshlata Cancer Hospital, Bareilly, U.P. This study will be conducted among 59 subjects having oral cancer in Bareilly city.

Sample Size Estimation:

The sample size estimation for this study was done using the formula:

- Sample size calculation: $\frac{4Pq}{d^2}$
- P is Prevalence of the previous study (P=63%),
- q is 100 - P (q=37%),
- d is allowable error (20% of P=12.6),
- Sample size = $\frac{4x63x37}{12.6^2}$ = 59

Inclusion Criteria:

- Adults aged above 18 years and diagnosed clinically and histopathologically with oral cancer.
- Patients who are able to give informed voluntary written consent.
- Ambulatory oral cancer patients to be included.
- Patient who shared biopsy report.

Exclusion Criteria:

- Subjects hospitalized due to systemic illness.
- Subjects having some form of physical handicap or mental disorder.

Method of Collection of Data:

This study will be conducted among 59 subjects having oral cancer in Bareilly city. Screening of the entire OSCC patient was done. From the list of well confirmed cases of OSCC who have the biopsy report were selected by simple random sampling method using a lottery method. Fifty-nine subjects were selected from the screened patients who fulfilled the inclusion and exclusion criteria and gave the consent. An informed consent form signed by all participants was obtained after explaining the entire procedure in their

vernacular language. A modified case history proforma and comprehensive history was conducted and results were reported. Daily Six subjects data was recorded alternatively from Rohilkhand Medical College and Hospital and Keshlata Cancer Hospital. The data collection took 15 days for all the subjects.

Procedure:

A clinical case history proforma which included patient's clinical details such as name, age, gender, medical history, address, detection hospital, diagnosis, re-occurrence etc. was recorded. Removing sweat, oil and dirt from the skin is important to improve the quality of dermatoglyphic prints. This was done by soap and water washing the ridged areas, followed by drying. Each subjects fingerprint was scanned with help of digital finger print scanner and this scanner was attached to the computer via USB port.

The dermatoglyphic prints of all the subjects were collected digitally using a laptop connected to a biometric scanner for finger prints & flatbed scanner for obtaining the palm prints of all the ten fingers of both left and right hands respectively (figure 1 and 2 respectively). Then using the 'Fingerprint Detector Software', the fingerprint was assessed and recorded and then saved in the computer. Analysis was conducted on fingerprint ridges and patterns

Figure 1: The photograph showing digital recording of finger ridge pattern in index finger of right hand

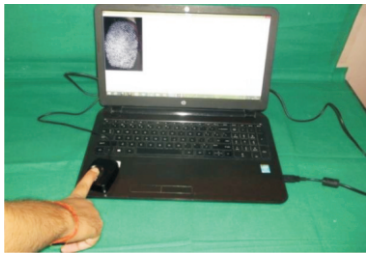


Figure 2: The photograph showing digital recording of palm print pattern of right hand

Dermatoglyphic Patterns Configuration:

A. Finger Ridge Patterns: According to the criterion of Sir Richard Henry (1897) 10 ridge pattern is divided into three forms:

a. Loops: This is the most common type of pattern consisting of a single core and a delta. It is formed when one or more epidermal ridges enter the patterned area on one side and bend and exit on one side. The loop pattern is further of two types:

i. Ulnar- The pattern area recurves and exit from the little finger side (Figure 3).

ii. Radial- The pattern area recurves and exit from the thumb side (Figure 4).

Figure 3: The digitally scanned finger print showing ulnar loop pattern

Figure 4: The digitally scanned finger print showing radial loop pattern

b. Arches: This is the simplest type of pattern with no delta. It is formed when one or more epidermal ridges enter from one side of the pattern area and leave the other to form an elevation in the center. The arch patterns are also available in two types depending on the elevations:

i. Plain- There is a small elevation in the middle (Figure 5).

ii. Tent- There is tent like elevation in the center (Figure 6).

Figure 5: The digitally scanned finger print showing plain arch pattern

Figure 6: The digitally scanned finger print showing tented arch pattern

c. Whorl: It includes the core and two deltas. The whorl pattern are divided into three types:

i. Central Pocket- It is formed by small loops that do not cross the line connecting the two deltas (Figure 7).

ii. Double Loop- It consists of two loops and two deltas separately (Figure 8).

iii. Plain- It is formed as a loop that surrounds the concentric rings pattern and touches or intersects the line connecting the two parts. (Figure 9).

Figure 7: The digitally scanned finger print showing central pocket whorl pattern

Figure 8: The digitally scanned finger print showing double loop whorl pattern

Figure 9: The digitally scanned finger print showing plain whorl pattern

B. Palmar Pattern Configurations:

The palm has been divided into several anatomically defined areas and includes thenar area; four inter digital areas (I 1 , I 2 , I 3 , I 4), and the hypothenar area.

C. Hypothenar Area:

Whorls, loops, and tented arches are patterns seen in the Hypothenar (HY) area. There are also simple arches, open fields, vestiges and multiplications of the ridge. As found in the hypothenar area, various ridge configurations and their combinations are illustrated.

D. Thenar And First Inter Digital Area:

These two fields are closely anatomically related and are considered to be one region called Thenar / First Inter Digital (TH / I1). The pattern (if any) is usually a loop. Specific ridge configurations and combinations of these are displayed as shown in the hypotenuse area.[1]

E. Second, Third, And Fourth Interdigital Area:

These areas are found in the distal palm in the region of the heads of the metacarpal bones. All digital areas are bounded by digital triradii on the side. Near the base of digits II-V, digital triradii are almost always found. Digital triradii, starting from the triradius at the base of digit II and moving toward the triradius associated with digit V, are marked a, b, c, and d. The second interdigital area (I 2) lies between the triradii a and b, the third interdigital area (I 3) between the triradii b and c, and the fourth interdigital area (I 4) between the triradii c and d. Loops (L), whorls (W), vestiges (V), and open fields (O) are the configurations contained in the interdigital regions. As found in the inter-digital area, various ridge configurations and their combinations are illustrated.

F. Finger Ridge Counting:

The counting ridge is used to identify the size of the pattern. It is mainly used as a way of expressing the distance in a given area between digital iradii and the ridge density on fingertips and toes. The count is made along a straight line that connects the triradii point to the core point (Figure 10).[1,11,12]

Figure 10: Showing the Method of Ridge Counting

G. Total Finger Ridge Counts (TFRC):

This represents the sum of all five fingers & #39; ridge counts. [1,11,12]

H. ab RIDGE COUNT: Counting is performed along a straight line that links both triradial points (a and b). [1,11,12]

I. Palmar Angle:

The observation of palm prints was manually accomplished as per the criteria given by of Penrose LS et al 13 after obtaining a printout on A4 size sheet. Four digital triradii were marked which are normally situated at the bases of digits ii (index finger), iii (middle finger), iv (ring finger) and v (little finger) known as 'a', 'b', 'c', and 'd', respectively. Axial triradius't' is located most near the proximal margin of the palm, closer to wrist line, in the space between thenar and hypothenar eminences. Depending upon the level of position of the axial triradius 't', a straight line drawn from axial triradius 't' to 'a', 't' t d', and 'a' to 'd' with the help of scale & amp; pencil; thus atd angle was measured by protractor (Figure 11).

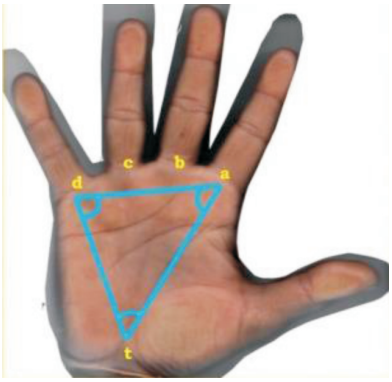
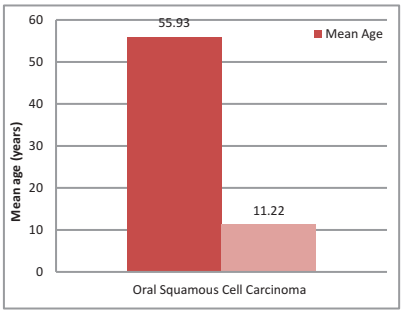


Figure 11: The scanned palm print showing adt angle

Statistical Procedure:

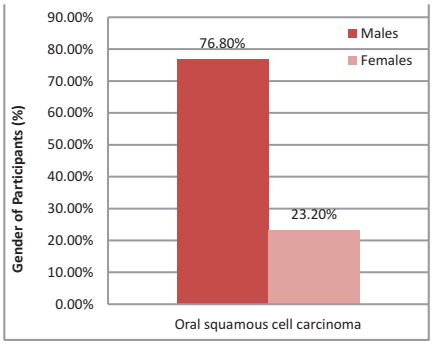
In the next stage, the distributed and completed questionnaires were collected and the obtained data was entered in MS Excel sheet (windows 2010). Results were calculated as Mean ± Standard deviation or number and percentage. Comparisons were carried out between the right and left hand. Chi-square test and Paired t-test was used for analyzing quantitative and qualitative data. A p-value of 0.05 or less was found to be statistically significant.

Graph 1: The tables showing the age wise distribution of OSCC, participant's age ranges from 31 to 85 years, mean age was 55.93 years ± 11.22 standard deviation. There was no significant difference in the age of patients.



Graph 1: Sample distribution among Oral Squamous Cell Carcinoma with age

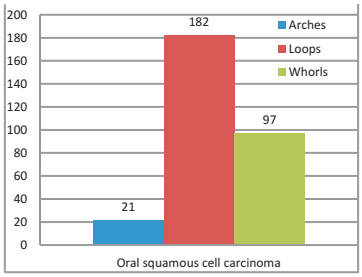
Graph 2: Shows the gender distribution among oral squamous cell carcinoma patients, there are 45 (76.8%) and 14 (23.2%) males and females respectively. There was no significant difference in gender distribution of patients.



Graph 2: Sample distribution among Oral Squamous Cell Carcinoma with gender

Graph 3: Shows the inferential data among the oral squamous cell carcinoma patients representing the frequency of different fingerprint patterns i.e. arches loops and whorls.

Among them 7% have arches, 60.7% have loops and 32.3% have whorls. The results were highly significant on intragroup comparison between the arches, loops and whorls (p=0.00).



Graph 3: Finger Print Pattern in Patients with Oral Squamous Cell Carcinoma

Table 1: Shows the distribution of adverse habits in Oral squamous cell carcinoma, tobacco was either used in smokeless (23.7%), smoke (54.2%) or both (22.1%) form by all the subjects participating in the study.

Table 1: The distribution of adverse habits in Oral squamous cell carcinoma.

Adverse Habits	Oral squamous cell carcinoma	Frequency
Smokeless	14	23.7%
Smoke	32	54.2%
Both	13	22.1%
Total	59	100%

Table 2: Shows the inferential data on hypothenar pattern in the oral squamous cell carcinoma patients. On individual group comparison between the both hands, it was found that the most ommonly observed hypothenar pattern was arch ulnar on the right hand, which was found statistically significant (p<0.05).

Table 2: Frequency of hypothenar pattern in the study group.

	OSCC (n=59) Group	X^2	p-value
Right	45 (76.7%)	1.986	**0.03***
Left	43 (73.3%)		

Significant value- p<0.005, SD- Standard Deviation, CI-95%

Table 3: When Thenar / I 1 area patterns of right and left hand in the OSCC group when compared revealed significant difference. In our study most often pattern was loops on left hand. The most commonly observed thenar/I 1 pattern was arch ulnar on the right hand (p<0.05).

Table 3: Frequency of thenar / I 1 pattern in the OSCC group

	OSCC (n=59) Group	X^2	p-value
Right	53 (90%)	0.891	**0.064***
Left	47 (80%)		

Significant value- p<0.005, SD- Standard Deviation, CI-95%

Table 4: Shows the comparison of distribution of I 2 , I 3 and I 4 area patterns in both right and left
hands.

Table 4: Frequency of I 2 , I 3 and I 4 area pattern in the OSCC group

	OSCC (n=59) Group	X^2	p-value
Right	28 (47.5%)	0.891	**0.11**
Left	31 (52.5%)		

Significant value- p<0.005, SD- Standard Deviation, CI-95%

Table 5: Shows the inferential data to compare the total finger ridge counts (TFRC) in both hands among the oral squamous cell carcinoma patients. There was marked increase in the number of total finger ridge counts on right hand when compared to the left. It was observed that this was statistically significant (p<0.05).

Table 5: Total finger ridge count

	RIGHT HAND			LEFT HAND			
	Mean	**S.D.**	**t-value**	**Mean**	**S.D.**	**F**	**P-value**
OSCC (n=59)	113.3	33.56	0.606	93.3	43.56	1.866	**0.016***

Significant value- p<0.005, SD- Standard Deviation, CI-95%

Table 6: Shows the frequency in the oral squamous cell carcinoma patients of the mean ab count in both hands. There was marked increase in the ab count on left hand were reported. It is observed that there was a significant difference in the mean ab count (p<0.05).

Table 6: ab Count

	RIGHT HAND			LEFT HAND			
	Mean	**SD**	**t-value**	**Mean**	**SD**	**F**	**P-value**
OSCC (n=59)	30.57	5.53	0.928	40.17	5.47	1.192	**0.030***

Significant value- p<0.005, SD- Standard Deviation, CI-95%

Table 7: The table showing the frequency of mean atd angles the oral squamous cell carcinoma patients of both right and left hands. Significant difference was noted (p< 0.05).

Table 7: atd angle

	RIGHT HAND			LEFT HAND			
	Mean	**SD**	**t-value**	**Mean**	**SD**	**F**	**P-value**
OSCC (n=59)	30.93	3.09	0.499	38.50	2.82	1.609	**0.021***

Significant value- p<0.005, SD- Standard Deviation, CI-95%

Discussion:

In 1926 (Cummins and Midlo), the term dermatoglyphics was coined to describe what had until then been referred to as epidermal ridge configurations. 14 Around the 13th week of prenatal life, these epidermal ridges begin to develop, as the foetal mounds on the digit tips, the interdigital, thenar and hypothenar areas of the hand and the corresponding areas of the foot begin to regress. The pattern formation is completed by the 19th week but does not alter during the entirety of prenatal and postnatal life once formed. 1 Heredity governs the dermal ridge patterns strongly, but not exclusively. 13 Qualitative and quantitative studies of dermatoglyphics inheritance have shown great similarities between identical twins and very strong inheritance between siblings and parents. Due to the great diversity in the types and combinations of patterns found on the fingers, palms and soles, it is obvious that many genes spread over many chromosomes would determine the formation of the dermal ridges. [15,16]

In 1936, Dr. Harold Cummins examined several children with trisomy 21 (Down's syndrome) and discovered consistent dermatoglyphic changes among controls that were absent. This earth-shattering discovery helped to move dermatoglyphics' budding science from a place of obscurity to being acceptable among medical personnel as a diagnostic tool. Since then, there was a widespread interest in medical epidermal ridges when it became apparent that many patients with chromosomal aberrations had unusual ridge formations. Therefore, inspection of skin ridges seems to have been a promising, simple, inexpensive means of determining whether a specific chromosomal defect was appropriate in a particular patient. [10,17]

Unusual ridge configurations have been observed to exist not only in patients with chromosomal defects but also in patients with single gene disorders and in few in whom the genetic basis of the disorder is unclear. [1]

As the population continues to grow, it is important to develop methods to effectively identify people at risk or who have certain diseases without compromising the quality of care. While this need is not a new concept, the use of dermatoglyphics is a unique and inexpensive way to identify such people.

The available data also suggests that the carcinogenic process is the result of an interaction between genetic susceptibility and exposure to exogenous carcinogens. In response to environmental influences, genetic damage accumulates more rapidly in people with genetic susceptibility to DNA damage than those with similar effects, although they are not unstable. Consequently individuals with genetic instability might be at a greater risk for developing these lesions. [9,16]

Since many of the genes involved in controlling dermatoglyphic development in the fingers and palms can indicate the development of malignant conditions 17,18 , identifying individuals at high risk for oral leukoplakia and oral squamous cell carcinoma may be important in reducing the incidence. Given the high mortality and high prevalence of oral cancer in India, we planned to evaluate the dermatoglyphic patterns of oral squamous cell carcinoma.

A qualitative analysis of the dermatoglyphic properties of patients with oral squamous cell carcinoma revealed the following data:

Finger Print Patterns:

In the present study the frequency of the finger print patterns in the OSCC group was significant. There was increased frequency of loops and whorls followed by arches in patients with oral squamous cell carcinoma. Loops were more frequently seen in oral squamous cell carcinoma which was contradictory to Jatti D et al 19 and Venkatesh E et al. 14 There are few studies to evaluate the dermatoglyphics patterns in cancer patients. A study by Chorlton et al 20 found a higher percentage of ulnar loops in cancer patients. Another study conducted in 201 Turkish cancer patients reported increased whorls and decreased radial loops. 21,22 A study by Lynch et al 23 on high-risk kindred oral cancers patient found that more whorls were present. Another study 22 revealed increased frequency of arches in the OSCC group. A study carried out by Gupta et al 24 also showed promising results. In OSCC, there was an increase in frequency of arch and ulnar loop patterns on fingertips decrease in frequency of simple whorl patterns on fingertips, and decrease in frequency of palmar accessory triradii on the right and left hands.

Hypothenar Area:

The most commonly observed hypothenar pattern was arch ulnar, which was evenly present in the OSCC group. On individual group comparison between the both hands, it was found that the most commonly observed hypothenar pattern was arch ulnar on the right hand, which was found statistically significant which was contradictory to Venkatesh E et al.[14]

Thenar / I 1 , Area:

Thenar / I 1 , area pattern, when compared to right and left hand in the OSCC group revealed significant differences, which was in contrast to Venkatesh E et al.[14] In our study most commonly found pattern was loops, which is in the similar studies were reported by Venkatesh E et al. [14]

I_2, I_3, I_4 are pattern

Loops were less common in OSCC group in I 2 , I 3 and I 4 areas, which was not significant and results were in contrast with Venkatesh E et al. [14]

Total finger ridge count:

A significant difference was observed in the mean TFRC in the study group. The result of certain studies 16,17,18,24 on palmar dermatoglyphics were analogous with our study where there was a decrease in the total finger ridge count. There was more number of total finger ridge counts on the right hand as compared to left, which came to be stastically significant. A study by Fuller et al [25] showed that there was a decreased ridge count in patients with cancer.

ab Count

There was stastically significant difference in the mean ab count of all the patients in both hands. There was more ab count on the left hand as compared to right, which is in agreement with studies of Venkatesh E et al 14 and Shetty P et al.[26]

atd angles

The atd angles when compared among the OSCC patients presented statistically significant differences. There was decrease in atd angle on the right hand, and decrease in frequency of palmar accessory triradii on the right hand, same results were showed by several studies.[14,20,27,28]

These differences in the dermatoglyphic patterns being genetic markers raise the possibility of detecting those who are predisposed to develop oral squamous cell carcinoma. The Dermatoglyphic studies of oral malignancies have been rarely performed, so more studies are needed with more samples to get results. The small sample size could be a limitation of our study.

Summary:

The present study was conducted to evaluate the association between dermatoglyphics and oral squamous cell carcinoma and to clarify the genetic contribution to the cause of squamous cell carcinoma. Fifty-nine patients with oral squamous cell carcinomas were included in the study after obtaining informed consent. Details of individuals participating in study were recorded in a modified case history proforma.

Palm and finger prints were taken using digital palm and fingerprint scanner. Following dermatoglyphic parameters were analyzed:

1. Finger print pattern.
2. Hypothenar pattern.

3. Thenar /I 1 area pattern
4. Total finger ridge count.
5. ab count
6. atd angles

Patterns were analyzed both qualitatively and quantitatively.

Results were tabulated and presented graphically. They were analyzed statistically and tested for statistical significance. There are several important parameters in the current study of palmar dermatoglyphic in oral squamous cell carcinoma. Based on the findings of the study, the following conclusions were reached.

Significant findings in patients with oral squamous cell carcinoma in both hand

- Increased in frequency of loops
- Increased in frequency of whorls
- Loop patterns are common in Thenar/I 1 area
- Increased Total finger ridge count on right hand
- Increased ab count on left hand
- More atd angle on left hand.

There were no significant differences in the following results for both hands:

- Frequency of loops in I 2 , I 3 , I 4 area.

Therefore, the data obtained from the oral squamous cell carcinoma patients would help in identifying individuals who have had or likely to have risk of developing oral squamous cell carcinoma. Health care workers should able to prevent oral squamous cell carcinoma by identifying high-risk people and taking precautions as soon as possible. [23,24]

Dermatoglyphics again proves that oral cancers are not only acquired in the environment, but its roots penetrate deep into the genetic soil. Further research on the link between squamous cell carcinoma and genetics could provide more valuable clues that will help prevent these diseases. And an attempt to make free mankind from these threatening diseases that are now spreading everywhere. 23 Thus, squamous cell carcinoma-based management could be a better medium now and in the future.

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