RESEARCH PAPER

A Dermatoglyphic Analysis of Palmar ATD, TDA, and DAT Angles in Patients with Breast Cancer

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Abstract

Background:
Dermatoglyphics is the scientific study of epidermal ridge patterns on the volar surfaces of the hands and feet. These dermal ridges develop around the sixth week of gestation and reach maximum formation between the twelfth and thirteenth weeks of intrauterine life. Breast cancer is the most commonly diagnosed cancer among women in India, followed by cervical cancer. Dermatoglyphic angle patterns may serve as non-invasive anatomical markers for assessing breast cancer risk.

Material and Methods:
The study included 60 female patients diagnosed with breast cancer as the case group and 60 healthy females as the control group. Palmar prints of both hands were obtained on clear, good-quality A4 white paper using the standard ink method described by Cummins and Midlo. The palmar angles ATD, TDA, and DAT were measured, and their significance was analyzed by comparing findings between the case and control groups.

Results:
Statistical analysis revealed that the mean ATD angle of the left hand was higher in the breast cancer cases compared to healthy controls, whereas the mean TDA angles of both hands were lower in cases than in the control group. However, no significant differences were observed in the DAT angles of either hand between the two groups.

Conclusions:
In the present study, palmar angles showed a significant association with breast cancer. These dermatoglyphic parameters may serve as a simple, reliable, and cost-effective non-invasive screening tool for identifying individuals at high risk, especially in resource-limited settings like India.

Keywords: Dermatoglyphics, Breast cancer, palmar angles, screening tool.
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Introduction

Dermatoglyphics is the scientific study of epidermal ridge patterns on the volar surfaces of the hands and feet. The term is derived from the Greek words dermis meaning skin and glyph meaning carving, and it involves the analysis of ridge configurations on the fingers, toes, palms, and soles [1].Dermatoglyphics has applications in anthropology, genetic studies, pediatrics, and psychiatry. Dermal ridges develop in relation to volar pads, which appear around the sixth week of gestation and reach maximum development between the twelfth and thirteenth weeks of intrauterine life [2].Breast cancer is defined as the uncontrolled growth of abnormal cells in the milk-producing glands (lobules) of the breast or in the ducts that carry milk to the nipples [3]. Breast carcinoma commonly presents with clinical features such as nipple retraction, ulceration of the overlying skin, and areas of necrosis [4].Breast cancer is the most frequently diagnosed cancer among women in India, followed by cervical cancer. It represents a significant health concern, with a large number of deaths occurring each year, largely due to delayed detection and limited access to early diagnostic measures. Globally, breast cancer remains a major public health challenge, with more than 1.7 million new cases reported in 2012 and approximately 6.3 million women living with breast cancer within five years of diagnosis [5]. The risk factors for breast cancer in women include increasing age, genetic mutations, and a family history of the disease. Additional contributing factors are a personal history of breast disease, prolonged exposure to estrogen and progesterone, and certain benign breast conditions. Environmental and lifestyle influences such as geographical and social factors, use of hormonal medications, prior radiotherapy, obesity, alcohol consumption, and smoking also increase the risk. Furthermore, reproductive factors including early menarche, late menopause, nulliparity, and first childbirth after the age of 30 years are recognized as important predisposing factors for breast cancer [6-7]. Two genes implicated in the pathogenesis of breast and ovarian cancer are BRCA1 and BRCA2. The BRCA1 gene is located on chromosome 17q21, while the BRCA2

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gene is situated on chromosome 13q12–q13 [8]. Dermatoglyphic angle patterns, specifically the ATD, TDA, and DAT angles, may serve as a non-invasive anatomical marker for assessing breast cancer risk and could therefore support earlier detection and treatment. The aim of this study was to investigate whether these angle patterns show any significant differences in patients diagnosed with breast cancer.

AIM and OBJECTIVES:

To study the association between malignant mammary neoplasm and palmar dermatoglyphic angles (ATD, TDA, and DAT) by measuring and comparing these angles in affected individuals and healthy controls.

MATERIALS AND METHODS:

The present study was carried out in the Department of Anatomy and the Department of Surgery at Trichy SRM Medical College Hospital & Research Centre, Trichy, Tamil Nadu, and India. Ethical approval for the study was obtained from the Institutional Ethics Committee (TSRMMCH&RC/ME-1/2021-IEC No: 021, dated 5th August 2021). The study consists of 60 female case group (breast cancer) and 60 female control group. The case group included 60 women between 20 and 80 years of age who were diagnosed with breast cancer. The diagnosis was confirmed through clinical examination, mammography, and histopathological analysis. In the control group, 60 healthy females in the age of twenty to 80 years were selected from female students, staff members of trichy SRM medical college and people living near to the SRM medical college with no family history of any type of cancers and any other genetically based disorders. The patients with the hypertension, diabetes, schizophrenia or mental retardation were excluded from the study. The informed consent was obtained from both control and case (breast cancer) groups.

The materials used in the present study included Kores quick-drying duplicating ink, a rubber roller, a round bottle, A4-size good quality white paper, an inking glass slab, cotton puffs, a protractor, and a magnifying hand lens. These materials were used for obtaining clear palmar prints and for measuring and analysing the dermatoglyphic palmar angles accurately. The accessory materials used in the study included good-quality HB pencils with pointed tips and a scale for accurate marking and measurement.

Study procedure:

After obtaining informed consent from participants in both the case and control groups, palmar prints were collected using the ink method described by Cummins and Midlo [1]. The hands of the subjects were first washed thoroughly with soap and water, and any greasy material was removed using spirit. After complete drying, a thin layer of quick-drying duplicating ink was evenly spread on a glass plate with the help of a roller. Each participant's hand was then gently pressed onto the inked surface to ensure uniform ink distribution. The inked hand was carefully placed on an A4-size white sheet positioned over a round bottle, and the hand was rolled from the base of the palm to the fingertips while gentle pressure was applied on the dorsum of the hand by the researcher to obtain clear and complete palmar prints.

Palmar landmarks.

The triradius is formed by the meeting of three ridge systems, and the geometric center of this convergence is known as the triradial point [9].Two types of triradii are typically identified on the palm:

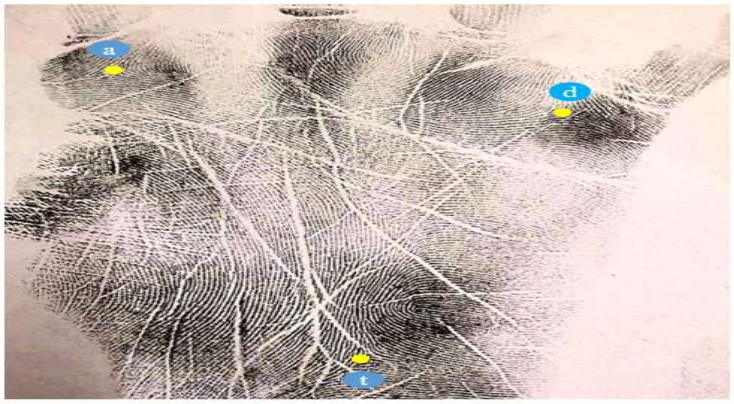


Figure 1: palmar landmarks-Digital ,Axial triradius and triradius point a,d and t (yellow dot)in the palm.

1. Digital triradii — these are consistently located proximal to the bases of the second and fifth digits and are designated as a and d triradii (Figure 1).

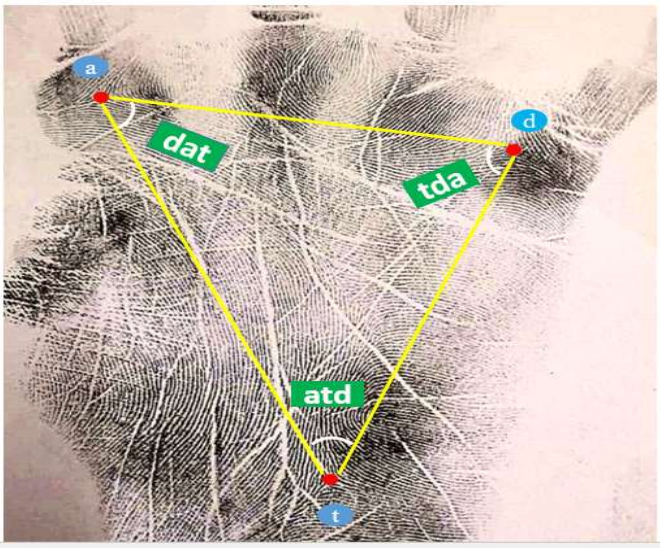
2. Axial triradius — this triradius is situated near the proximal border of the palm, within the depression between the thenar and hypothenar eminences. Its position varies and is commonly referred to as the t triradius (figure 1)

Palmar angles.

The ATD angle is the angle formed by lines drawn from the axial triradius (t), located on the lower outer part of the palm, to the digital triradii a and d, found near the bases of the index and little fingers, respectively (figure 2).

The TDA angle is formed by drawing lines connecting the triradius t with triradii d and a. The axial triradius t is located near the proximal part of the palm, while triradii a and d are situated at the bases of the index and little fingers, respectively (figure 2).

The DAT angle is formed by drawing lines from the digital triradius d to triradii a and t. The triradii a and d are located near the bases of the index and little fingers, respectively, while the axial triradius t lies near the proximal region of the palm (figure 2).



dependent't'- test were used to fference between groups. P< statistically significant.

Groups (TDA an	hand (Mean±SD)
Cases	6.10
Controls	±4.70
P-Value	

of the mean ATD angles of the ands in both groups.

The mean ATD angle of the right hand was 44.20° in cases and 44.50° in controls, showing a slightly lower value in cases; however, the difference was not statistically significant (p=0.509; p> 0.05). In contrast, the mean ATD angle of the left hand was 46.80° in cases and 44.51° in controls, with lower values observed in the control group. This difference was found to be statistically significant (p=0.031; p< 0.05).

Groups (ATD angles)	Right hand (Mean ± SD)	Left hand (Mean ± SD)
Cases	44.2±5.81	46.8±6.80
Controls	44.5±5.49	44.51±4.47
P-Value	0.509	0.031

Figure 2: palmar angle atd,dat and dat in the palm.

Observations thus made were compiled and tabulated. The collected data was statically analysed with statistical package for the social sciences (SPSS) software version 26.All the readings were expressed in mean and standard deviation in palmar angles and were compared between right and left sides of palm of both

Palmar TDA angles.

Table 2: A comparison of the mean TDA angles of the right and left hands in both groups.

The mean TDA angle of the right hand was 78.50° in cases and 80.36° in controls, showing lower values in cases, and the difference was statistically significant (p = 0.039; p< 0.05). Similarly, the mean TDA angle of the left hand was 76.80° in cases and 79.71° in controls, with cases demonstrating lower values than

controls. This difference was also found to be statistically significant ($p = 0.004$; $p < 0.05$).

Palmar DAT angles.

Table 3: A comparison of the mean DAT angles of the right and left hands in both groups.

Groups (DAT angles)	Right hand (Mean±SD)	Left hand (Mean±SD)
Cases	56.46±5.10	55.86±7.67
Controls	54.56±5.58	55.23±5.94
P-Value	0.059	0.615

The mean DAT angle of the right hand was 56.46° in cases and 54.56° in controls, with lower values observed in the control group. However, this difference was not statistically significant ($p = 0.059$; $p > 0.05$). Similarly, the mean DAT angle of the left hand was 55.86° in cases and 55.23° in controls, with the control group again showing lower values compared to cases. This difference was also not statistically significant ($p = 0.615$; $p > 0.05$).

DISCUSSION:

Palmar ATD angle.

Prashant E. Natekar and Fatima M. Desouza et al. (2006) reported a statistically significant difference in ATD angle analysis between the study groups [10]. Sridevi et al. (2010), the ATD angle was compared between the experimental group and the control group. The analysis revealed no statistically significant difference in the ATD angle of either hand. The right-hand ATD angle showed a p-value of 0.781 ($p > 0.05$), while the left-hand ATD angle demonstrated a p-value of 0.446 ($p > 0.05$), indicating that the ATD angle did not vary significantly between the two groups [11]. Sharma k et al.(2015)The mean atd angle in the control group was 44.56° for the right hand and 44.12° for the left hand. In contrast, the patient group demonstrated lower mean atd angles of 38.84° in the right hand and 39.58° in the left hand. This reduction in the atd angle among patients was found to be statistically significant [12]. Gul S et al. (2018) study comparing 40 breast cancer patients with 40 healthy women reported significantly higher mean atd angles in the patient group. The right-hand atd angle (42.65±4.14 vs 37.18±2.58) and left-hand atd angle (42.93±3.93 vs 38.15±2.68) were both significantly increased in breast cancer patients ($p < 0.001$) [13]. In the present study, the mean ATD angle was higher in the control group for the right hand; however, this difference was not statistically significant. In contrast, the mean ATD angle of the left hand was greater in the case group, and this difference was found to be statistically significant.

Palmar TDA angles.

Sharma k et al.(2015) the mean tda angle in the control group was 80.22° for the right hand and 81.90° for the left hand. In comparison, patients exhibited higher mean tda angles of 82.48° in the right hand and 82.02° in the left hand. This increase in the tda angle among patients was found to be statistically significant [12].Sukree S.B. et al. (2004) evaluated dermatoglyphic patterns in 50 patients diagnosed with breast carcinoma and compared them with 50 healthy controls. The findings indicated that there was no statistically significant difference in the atd angle between the two groups [14]. Madhavi D et al.(2016) reported that there was no statistically significant difference in the ADT angle between the study group and the control group [15].

Palmar DAT angles.

Sridevi NS et al.(2010) reported that the mean ‘dat’ angles did not show a statistically significant difference between carcinoma breast patients and the control group in either hand [11]. Johri V et al. (2020) reported that the mean ‘dat’ angle was comparable between cases (58.9 ± 6.83) and controls (59.2 ± 5.58), with no statistically significant difference observed [16].Raizada et al. (2023) observed a significantly lower ‘dat’ angle in the right hand of cancer patients relative to controls ($p < 0.01$), along with the presence of fluctuating asymmetry in the ‘dat’ angle [17].

CONCLUSION:

In the present study, the mean ATD angle of the left hand was significantly higher in breast cancer cases, while the mean TDA angles of both hands were significantly lower compared to controls. A significant association was observed between breast cancer and the ATD angle of the left hand as well as the TDA angles of both hands, suggesting that specific dermatoglyphic angle variations may be linked to breast cancer susceptibility. Since dermatoglyphic patterns are genetically determined and remain stable throughout life, they may serve as reliable biological markers for identifying individuals at risk. Dermatoglyphic analysis is non-invasive, cost-effective, and easy to perform, making it particularly useful in rural and resource-limited settings where advanced diagnostic facilities are limited. Individuals identified as high risk can be referred for further

confirmatory tests. This approach may be especially beneficial for individuals with a family history of carcinoma, as it enables early risk prediction and monitoring. Therefore, dermatoglyphic analysis, particularly ATD and TDA angles, may serve as a supportive preliminary screening tool for early identification of women at risk of breast cancer, facilitating timely intervention and improved clinical outcomes.

CONFLICTS OF INTERESTS: None

AUTHOR CONTRIBUTIONS

All the authors have properly read and approved the manuscript.

Dr. S. Kavitha: reviewing the article, study concept, statistical work.

Mr.Veeramuthu.M: Data collection, data analysis, study concept, interpretation, writing and editing the paper.

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Reference:

1.Cummins and Midlo–Finger Prints palm and soles, introduction to dermatoglyphics Dover

Publication Inc. New York, 1961.

2. Babler W. Embryologic development of epidermal ridges and their configurations. In: Dermatoglyphics: Science in transition. Birth defects (Edited by: CC P, RM G, BA S). Wiley-Liss: New York; 1991. p. 95-112.

3. Garcia M et al. Global Cancer Facts & Figures. Atlanta, GA: American Cancer Society, 2007.

4. Zhang BN, Cao XC, Chen JY, et al. Guidelines on the diagnosis and treatment of

Breast cancer (2011 edition). Gland Surg. 2012;1(1):39-61.

5. Ferlay J, Soerjomataram I, Ervik M, Dikshit R, Eser S, Mathers C, et al. GLOBOCAN 2012 v1.0, Cancer Incidence and Mortality Worldwide: IARC Cancer Base No. 11. Lyon, France: International Agency for Research on Cancer; 2013.

6. Morrow M, Jordan VC. Managing Breast Cancer Risk, BC Decker Inc, Hamilton, 3. 2003.

7. Hulka, B.S. and Stark, A.T. Breast cancer: cause and prevention. Lancet. 1995; 346: 833.

8. Morrison PJ, Hodgson SV, Haites NE. Familial Breast and Ovarian Cancer: Genetics, Screening and Management, Cambridge University Press, New York, 2002.

9. Schaumann B and Alter M. Dermatoglyphics in medical disorders. New York: Springer 1976:22-87.

10. Prashant E.Natekar, Fatima M. And De Souza. Fluctuting asymmetry in dermatoglyphics of carcinoma of breas. Indian Journal of Human Genetics. May – august 2006;12(2):76-81.

11. Sridevi NS, Wilma Delphine Silvia CR, Kulkarni R, Seshagiri C. Palmar dermatiglyphics in carcinoma breast of Indian women, Romanian Journal of Morphology and Embryology. 2010; 51(3): 547-550.

12. Sharma K, Arora R, Pareek A. A Study of Dermatoglyphic Patterns (angles' atd"tad"tda') of Hands in Patients of Breast Cancer in Jhalawar Region. Indian Journal of Anatomy. 2015 May 1;4(2):61.

13. Shazya G, Nusrat J, Sangeeta G. Palmar dermatoglyphic and breast cancer: a possible correlation. International Journal of Medical and Health Research. 2018;4(2):53-.

14. S.B.Sukree, AAMahajan. Dermatoglyphics in the identification of women either with or at risk for breast cancer. 51st journal of Anatomical society of India. 5(1); 2004-01; 2004-06.

15.Madhavi D, Dorairaj S, Dorairaj SS, Kommuru H. Dermatoglyphic study in breast carcinoma patients. International Journal of Science and Research. 2016;5(10):837-40.

16.Johri V, Raizada A, Takiar R. Evaluation of palmar angles in carcinoma breast patients and in normal healthy females. Int J Anat Radiol Surg. 2020;9(1).

17.Aprajita Raizada, Vishwas Johri, Ramnath Takiar. Exploring Fluctuation Asymmetry in Dermatoglyphic Patterns as Potential Indicators of Breast Carcinoma: A Comparative Analysis.International Journal of Pharmaceutical and Clinical Research 2023; 15(7); 739-743.