

ADERMATOGLYPHIA: Challenges and Prospects in diagnosis

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ABSTRACT: BIOMETRIC METHODS ARE INCREASINGLY BEING USED ALL OVER THE WORLD FOR INDIVIDUAL IDENTIFICATION AND AUTHENTICATION. MOST METHODS ARE COMPLEX, HOWEVER, THE USE OF FINGERPRINTS ARE LESS COMPLEX, CHEAPER, READILY AVAILABLE AND THUS WIDELY USED COMPARED TO OTHER MODALITIES. THE AVAILABILITY OF FINGERPRINTING HAS EXPOSED MORE CASES OF ADERMATOGLYPHIA WHICH IS CLINICALLY DEFINED AS THE LOSS OF FINGERPRINTS. IT CAN BE CONGENITAL OR ACQUIRED, REVERSIBLE OR IRREVERSIBLE. DIAGNOSIS OF MOSTLY THE CONGENITAL FORMS WILL REQUIRE MOLECULAR GENETIC ANALYSIS WHICH MAY BE DIFFICULT TO ACCESS IN THIS PART OF THE WORLD AND VOLAR PAD BIOPSY WHICH INDIVIDUALS MAY NOT CONSENT TO. THE NEED FOR ALTERNATIVE MODALITIES OF IDENTIFICATION SHOULD BE IN PLACE IN CASES WHERE FINGERPRINTING IS AN ISSUE. THIS ARTICLE WILL REVIEW THE CHALLENGES FACED WHEN DIAGNOSING ADERMATOGLYPHIA AND FUTURE PROSPECTS FOR PATIENTS.

1. INTRODUCTION (ARIAL, BOLD, 11 FONT, LEFT ALIGNED, CAPS)

THE SCIENTIFIC STUDY OF INTRICATE PATTERNS AND FINGERPRINTS FROM PALMS, FINGERS, SOLES AND TOES IS REFERRED TO AS DERMATOGLYPHICS¹. THESE NATURALLY OCCURRING PATTERNS ARE UNIQUE TO AN INDIVIDUAL AND REMAIN UNCHANGED FROM BIRTH UNTIL DEATH²⁻⁴. THE FINGERPRINTS ARE NOT EVEN SIMILAR IN MONOZYGOTIC TWINS. FINGERPRINTING KNOWN AS DACTYLOGRAPHY IS THE SINGLE MOST WIDELY UTILIZED METHOD FOR INDIVIDUAL IDENTIFICATION AND AUTHENTICATION (I&A)^{2,4}. ADERMATOGLYPHIA IS CLINICALLY DEFINED AS THE CONGENITAL OR AN ACQUIRED LOSS OF THE EPIDERMAL RIDGE PATTERN⁵. IT CAN ALSO BE COMPLETE OR PARTIAL LOSS OF THE EPIDERMAL RIDGE PATTERN. IT CAN ALSO BE REVERSIBLE OR IRREVERSIBLE. IT IS ALSO CALLED "IMMIGRATION DELAY DISEASE"^{4,5}. PATIENTS WITH THIS CONDITION ARE FACED WITH DIFFICULTIES WHEN UNDERGOING BIOMETRICS AND THIS CAN BE BURDENSOME AND DEPRESSING FOR PATIENTS ESPECIALLY IF IT IS IRREVERSIBLE. ALTERNATIVE METHODS OF IDENTIFICATION, AUTHENTICATION AND VERIFICATION ARE NOT READILY AVAILABLE.

2. HISTORICAL PERSPECTIVE: IN 1684, A LEARNED AND INGENIOUS PHYSICIAN, NEHEMIAH GREW, PUBLISHED THE FIRST DESCRIPTION OF THE EPIDERMAL RIDGES WHICH MAKE CHARACTERISTIC PATTERNS WHEN PRINTS ARE TAKEN OF FINGERTIPS^{1,6} IN 1890, SIR GALTON DEMONSTRATED THE VALUE OF FINGERPRINTS FOR PERSONAL

IDENTIFICATION AND THEIR PERMANENCE THROUGHOUT LIFE^{6,7}. ANOTHER RESEARCHER, JAUN VUCETICH IN 1892 FIRST USED FINGERPRINTS TO IDENTIFY CRIMINALS IN THE COURT ROOM¹. DERMOLYPTICS WAS COINED BY CUMMINS AND MIDLO IN 1926, DERMA" MEANS SKIN AND "GLYPHIC" MEANS CARVINGS⁴. BAIRD (1964) DESCRIBED A KINDRED OF IRISH-AMERICAN EXTRACTION IN WHICH 13 OF 24 MEMBERS OF THREE GENERATIONS SHOWED AN ABSENCE OF DERMAL RIDGES⁸. IN 2007, A SWISS WOMAN WAS DENIED ENTRY INTO THE US BECAUSE SHE HAD NO FINGERPRINTS⁵. SIMILAR ISSUE WAS REPORTED IN BENUE STATE, NIGERIA, WHERE A CHRISTIAN PILGRIM WAS DENIED THE E-PASSPORT BY THE NIGERIAN IMMIGRATION⁹. OVER THE PAST 50 YEARS, A LOT OF WORK HAS BEEN DONE ON VARIOUS ASPECTS OF DERMOLYPTICS AND DEVELOPMENTAL DISORDERS. MOST PATIENTS WITH CHROMOSOMAL DISORDERS LIKE DOWN SYNDROME, EDWARD SYNDROME, PATAU SYNDROME HAVE ABNORMAL DERMOLYPTIC PATTERNS⁴.

3. FINGERPRINT PATTERN AND IMPORTANCE:

THE FINGERPRINT PATTERN OF THE EPIDERMAL RIDGES FORM WHORLS, ARCHES, AND LOOPS THAT ARE THE BASIS FOR EACH PERSON'S UNIQUE FINGERPRINTS^{1,2}. THESE, LIKE DNA ARE UNIQUE TO EVERY INDIVIDUAL AND ARE USED AS MEANS OF IDENTIFICATION AND AUTHENTICATION. THEY ARE UNIQUE AND DIFFICULT TO ALTER MAKING THEM LIFELONG MARKERS FOR IDENTIFICATION OF INDIVIDUALS. THEY ARE IMPORTANT DERMATOLOGICAL LANDMARKS WITH SUBSTANTIAL APPLICATIONS IN MEDICINE, FORENSICS, ANTHROPOLOGY, AND SECURITY¹. THE EPIDERMAL RIDGES USUALLY DEVELOP AROUND 10 TO 17 WEEKS POST-FERTILIZATION, AND THEIR FORMATION IS INFLUENCED BY GENETIC AND ENVIRONMENTAL COMPONENTS^{1,6,10}. IN NIGERIA FINGERPRINT BIOMETRICS ARE USED FOR IDENTIFICATION DURING BANKING TRANSACTIONS, NATIONAL REGISTRATION, IMMIGRATION, FORENSICS, BUILDING AND DOOR ACCESS, PHONE ACCESS ETCETERA.

ABSENCE OF FINGERPRINTS CAN BE CONGENITAL OR ACQUIRED⁴. THE CONGENITAL CAUSE INCLUDE THE ISOLATED CONGENITAL ADERMOLYPTIA AND ADERMOLYPTIA AS PART OF SYNDROMIC MANIFESTATION OF CONGENITAL DISEASES. THE ISOLATED CONGENITAL FORM IS SAID TO BE AN AUTOSOMAL DOMINANT CONDITION LINKED TO A MUTATION OF THE SMARCD1 GENE^{2,5,11}.

THESE CONGENITAL DISEASES MOSTLY DUE TO ECTODERMAL DYSPLASIAS INCLUDE BASAN SYNDROME, NAEGELI-FRANCESCHETTI-JADASSOHN SYNDROME, DERMATOPATHIA PIGMENTOSA RETICULARIS, RETICULATE ACROPIGMENTATION OF KITAMURA, ROTHMUND THOMAS SYNDROME. COMMON ACQUIRED CAUSES INCLUDE BUT NOT LIMITED TO DERMATITIS, HYPERHIDROSIS, USE OF CHEMOTHERAPEUTIC AGENTS LIKE CAPECITABINE, DRUG INDUCED RASH, TRAUMA AND CAUSTIC ABRASIONS^{4,12}.

4. CHALLENGES:

DIAGNOSING ADERMATOGLYPHIA IN NIGERIA IS QUITE CHALLENGING. PATIENT USUALLY PRESENT WITH DIFFICULTY IN CAPTURING FINGERPRINT DURING BIOMETRICS, FURTHER EVALUATION TO ENABLE THE ATTENDING PHYSICIANS GET A SPECIFIC CAUSE IS HALTED BY LACK OF MOLECULAR GENETIC TESTING. THIS IS THE PRIMARY INVESTIGATION TO ASCERTAIN WHETHER THE PATIENT HAS SMARCAD 1 GENE AND KERATIN 14 MUTATION WHICH ARE THE MAJOR GENE MUTATIONS SEEN IN ADERMATOGLYPHIA¹³. THESE INVESTIGATIONS ARE NOT READILY AVAILABLE AND AS SUCH POSES A GRAVE SETBACK AT ARRIVING AT A DEFINITIVE DIAGNOSIS. OTHER INVESTIGATIVE MODALITIES LIKE VOLAR PAD BIOPSY ARE USUALLY DECLINED BY PATIENTS. ANOTHER CHALLENGE IS TRACING OF FAMILY MEMBERS TO ASCERTAIN WHETHER THEY ALSO HAVE ADERMATOGLYPHIA.

PROSPECTS: ADVANCING TECHNOLOGY HAS MADE BIOMETRIC ANALYSIS OF INDIVIDUALS A COMMON TREND. DERMOTGLYPHICS IS A COMMONLY UTILIZED METHOD FOR DATA COLLECTION, BIOMETRIC ASSESSMENT AND VERIFICATION. IT CAN BE DEPLOYED FOR USE FOR A LARGE NUMBER OF INDIVIDUALS AS IT IS LESS COMPLEX COMPARED TO OTHER MODALITIES. IN PATIENTS WITH ADERMATOGLYPHIA, ALTERNATIVE BIOMETRIC MODALITIES SHOULD BE IN PLACE AS OPTIONS FOR VERIFICATION. THE NIGERIAN IMMIGRATION SERVICE USE PHOTOGRAPHIC IMAGE OF THE FACE AND PALM PLUS FINGERS WITH A VALID DOCTORS' REPORT AS A MEANS OF IDENTIFYING INDIVIDUALS WITH ADERMATOGLYPHIA. BACK UP BIOMETRIC METHODS SHOULD BE UNIQUE, READILY AVAILABLE, GENERALLY UNIVERSALLY PRESENT, WITH UNCHANGING AND QUANTIFIABLE RESULTS THROUGHOUT THE LIFESPAN OF THE INDIVIDUAL. THESE CHARACTERISTICS MAKE IT DIFFICULT TO CHOOSE A PARTICULAR ALTERNATIVE. AVAILABLE BIOMETRIC METHODS THAT CAN BE USED AS BACK UP FOR PATIENTS WITH ADERMATOGLYPHIA INCLUDE PHYSIOLOGICAL SUBTYPES (FACE RECOGNITION, PALM PRINT, HAND GEOMETRY, IRIS AND RETINAL SCAN), AND BEHAVIORAL SUBTYPES (SIGNATURES, KEYSTROKE, AND VOICE AND GAIT PATTERNS)^{14,15}. OTHER HIGH-TECH BIOMETRIC PARAMETERS THAT HAVE BEEN STUDIED INCLUDE FINGER VEIN PATTERN, TONGUE PRINTING, ELECTROCARDIOGRAPHY AND RADIO-FREQUENCY IDENTIFICATION TECHNOLOGY^{14,15}.

CONCLUSION:

MORE CASES OF ADERMATOGLYPHIA ARE BEING SEEN BECAUSE OF INCREASED NEED FOR INDIVIDUAL IDENTIFICATION AND AUTHENTICATION USING BIOMETRIC METHODS IN COUNTRIES AROUND THE WORLD AND NIGERIA IN PARTICULAR. THE NEED FOR ALTERNATIVE MODALITIES OF IDENTIFICATION SHOULD BE IN PLACE IN CASES WHERE FINGERPRINTING IS AN ISSUE.

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