"STUDY OF PALMAR DERMATOGLYPHIC PATTERN IN EPILEPTIC PATIENTS OF KLES DR. PRABHAKAR KORE HOSPITAL AND MEDICAL RESEARCH CENTRE, BELGAUM – A CROSS SECTIONAL STUDY"

By

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Dissertation submitted to the
KLE University, Belgaum, Karnataka

In Partial Fulfillment
of the requirements for the degree of

M. D. (ANATOMY)

Under the Guidance of

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DECLARATION

I hereby declare that this dissertation entitled **"STUDY OF PALMAR DERMATOGLYPHIC PATTERN IN EPILEPTIC PATIENTS OF KLES DR. PRABHAKAR KORE HOSPITAL AND MEDICAL RESEARCH CENTRE, BELGAUM – A CROSS SECTIONAL STUDY"** is a bonafide and genuine research work carried out by me under the guidance of **Dr. V. S. SHIROL** $_{\mathbf{MS}}$ Professor and Head, Department of Anatomy, Jawaharlal Nehru Medical College, Nehru Nagar, Belgaum – 590 010.

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Date:

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LIST OF ABBREVIATIONS USED

A	-	Arch
a,b,c,d,	-	Digital triradius
A.T.	-	Axial triradius
Hyp	-	Hypothenar
I_1, I_2, I_3, I_4	-	Interdigital areas
L_1	-	Left thumb
L_2	-	Left index finger
L_3	-	Left middle finger
L_4	-	Left ring finger
L_5	-	Left little finger
O	-	Open field
R_1	-	Right thumb
R_2	-	Right index finger
R_3	-	Right middle finger
R_4	-	Right ring finger
R_5	-	Right little finger
RL	-	Radial loop
RH	-	Right hand
S.D.	-	Standard deviation
t	-	Axial triradius
TFRC	-	Total finger ridge count
Th	-	Thenar
TTR	-	Total triradii
UL	-	Ulnar loop
V	-	Vestiges
w	-	Whorl
x^2	-	Chi square

ABSTRACT

Background and objectives

Epilepsy is a group of disorders in which there are recurrent episodes of altered cerebral function associated with paroxysmal excessive hypersynchronous discharge of cerebral neurons. The objectives of the present study were to find out various dermatoglyphic features in patients suffering from epilepsy and to compare the dermatoglyphic features in normal and epileptic patients.

Methods

The present cross sectional study was conducted during the period from January 2007 to December 2007 on age and sex matched 70 epileptic patients and 70 normal individuals. Patients selected from those attending Out Patient Department of Neuromedicine, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum aged between 5 and 40 years. Among the various methods used for recording dermatoglyphics, the most routinely used ink method was used for this study. The finger and palm prints were analyzed qualitatively and quantitatively. The qualitative analysis included the finger print patterns and palmar patterns and quantitative analysis included total finger ridge count and atd angles.

Results

Significant findings in qualitative analyses of male epileptic patients showed increase in frequency of radial loops on finger tips of right and left index fingers and decrease in frequency of whorls on right thumb, index, ring and left ring finger. In female epileptics, there was increase of interdigital fourth pattern

in both hands. Significant findings in quantitative analysis of epileptic patients included increase of total finger ridge count in male and female epileptics.

Conclusions and interpretation

Thus with the help of these parameters, one can conclude that, there is some genetic basis for epilepsy and it is possible to a certain extent to predict from dermatoglyphic studies, individual's tendency for acquiring epilepsy.

Key words

Epilepsy; dermatoglyphics; Finger print pattern; Thenar pattern; Hypothenar pattern; Interdigital pattern; Total finger ridge count.

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INTRODUCTION

Epilepsy is a group of disorders in which there are recurrent episodes of altered cerebral function associated with paroxysmal excessive hypersynchronous discharge of cerebral neurons.

Epilepsy means a tendency to have seizures and is a symptom of brain disease rather than a disease itself. The recurrence rate after a first seizure approaches 70% during first year and more recurrent attacks occurs with in a month or two of the first. Further seizures are less likely if a trigger factor is definable and avoidable. The annual incidence of new cases of epilepsy after infancy is 20 to 70 per 100,000. The incidence of epilepsy in general population in India is one percent. Epilepsy is probably a familial hereditary disease transmitted as an autosomal dominant characteristic with variable expressivity.[1] Dermatoglyphics is a branch of genetics dealing with the skin ridge system. Each dermatoglyphic configuration is unique and no two persons, not even uniovular twins, show exactly similar finger print pattern. Epilepsy and dermatoglyphics both have strong genetic basis.

Dermatoglyphic analysis as a diagnostic tool has many advantages.

- The epidermal ridge patterns on the palm are fully developed at birth and remain unchanged throughout life.
- Patterns are readily accessible.
- Recording is quick, simple and inexpensive.
- There is no trauma to individual during recording.

- Ridge patterns can quickly be analyzed.
- Ridge pattern can be inspected for abnormalities immediately after birth.

Dermatoglyphics has been studied extensively in chromosomal disorders and studies proved quite useful in the medicolegal, anthropological and clinical fields. Currently several dermatoglyphic research workers, claim a very high degree of accuracy, in their prognostic ability, from the hand features in diseases like diabetes mellitus, schizophrenia, hypertension and some chromosomal disorders.[2]

The epileptic patients are available in large number and they along with their families, tagged with social stigma face lots of hardships and studies in epilepsy are scanty in India and abroad.

Taking these facts into consideration, the present study aims to determine various dermatoglyphic features in epileptic patients and compare them with the normal individual. By this we can establish the importance of dermatoglyphics as an useful investigatory or inexpensive screening procedure for the population at risk, so that anticipation and early detection of symptoms help in averting the disease or complications associated with the disease.

OBJECTIVES

The objectives of the present study were;

1. To find out various dermatoglyphic features in patients suffering from epilepsy.
2. To compare the dermatoglyphic features in normal and epileptic patients.

REVIEW OF LITERATURE

Dermatoglyphics

The term dermatoglyphics was coined by Cummins and Midlo in 1926 (In Greek 'derma' means skin and 'glyphic' means carve).

History of dermatoglyphics

In the past, man was fully aware of the pattern of ridges on his fingers and palm. In the past finger prints were used for various purposes such as fortune telling, superstition, magic and symbolism.

The use of finger prints for personal identification is well known and had it's origin in the East. In China, for many centuries, the thumb print of the Emperor was the ruler's mark on the letters of state.

An English doctor, Nehemiah Grew was the first person to describe pores, ridges and arrangements on the palm and fingers in the year 1684. In the following year, Bidloo in his book on Human Anatomy, included details of ridges on thumbs. A year later in 1686, Marcello Malphigi an Italian Physiologist mentioned briefly about the ridges on palms and fingers. The dawn of eighteenth century, heralded the review of anatomical works in dermatoglyphics. C. J. Hintz and Albinus both Anatomists, described ridges on palms and soles. In the early nineteenth century, Purkinje, Professor of Anatomy at Breslau University classified the finger print pattern into nine basic types.[3]

Sir Francis Galton of London, an anthropologist and eugenicist, classified the epidermal pattern under "Galton's system", and gave a detailed account of morphology, inheritance and racial variations of ridges.[4]

Harold Cummins, a Professor of Anatomy in Tulane University, was the first person to show that palm and fingerprints could be of use in clinical medicine. He published the book "An Introduction to Dermatoglyphics" with the help of Midlo. This book is indispensable in dermatoglyphics and has world wide recognition.[5]

Holt from Galton laboratory London devised a method of ridge count and introduced quantitative element in the study of finger prints.[6] Penrose organized an International symposium on dermatoglyphics and brought out "Memorandum on dermatoglyphics nomenclature".[7] Fuller analysed variety of dermatoglyphic data in various diseases to know whether it can be used as a diagnostic aid.[8] Mavalwala J reviewed the work of Harold Cummins in dermatoglyphics.[9]

In India workers in various disciplines namely Srinivas MR and Wig NN in schizopherenics[10] and Bhanu in anthropology contributed a great deal to dermatoglyphics.[11]

Embryogenesis of Human Epidermal Ridges

Dermal ridge differentiation takes place early in foetal development. The resulting ridge configurations are genetically determined and are influenced by environmental forces. It has been noted that the ultimate epidermal ridge pattern forms at the sides of foetal volar pads. Foetal volar pads are mound shaped elevations of mesenchymal tissue, situated above the proximal and on the most

distal phalynx of each finger. They are also located in each interdigital area and as well as in thenar and hypothenar areas of palms and soles as well as in calcar area of sole. The formation of these pads is first visible on the finger tips in the sixth to seventh week of embryonic development. The pads become very prominent during the subsequent weeks, diminish again in the fifth month and disappear completely in the sixth month. Within this period, the dermal ridges coalesce into specific pattern, replacing the volar pads. The presence of volar pads as well as their size and position are responsible for the configuration of papillary ridge pattern, as postulated by Bonnevie. For example small pads would result in a simple configuration (arch), whereas more prominent pads would tend to lead to the development of large and more complex system of ridge configuration (loops and whorls).

Similarly, foetal pads positioned symmetrically on the volar aspect of the fingertip would give rise to pattern centered in the middle of the pattern area (whorl). Asymmetrical pads positioning leads to a pattern asymmetrically oriented within the pattern area (loop, either ulnar or radial according to the position of the pad). It has been established that the critical period of ridge formation begins in the foetus at approximately 70 mm crown rump length that is about, three months of age, when the volar pads are near or just beyond their peak development. The epidermal ridge patterns are completed only after the sixth prenatal month, when the glandular folds are fully formed and after the sweat gland secretion and keratinisation have begun. At this time the configuration on the skin surface begin to reflect the underlying patterns. The surface epidermal furrows correspond to the furrow folds of stratum germinativum and each

epidermal ridge is formed above a glandular fold. Ridge differentiation progresses from the apical pads proximally and in a radioulnar or tibiofibular direction.[12]

Several hypotheses have been formulated concerning the forces that are responsible for the development of specific ridge pattern. An author speculated, that the dermal ridge configurations were the result of physical and topographic growth forces. It is believed that the tensions and pressures in the skin during early embryogenesis determine the direction of the epidermal ridges. A study has postulated that underlying arrangement of peripheral nerves may determine the direction of epidermal ridges.[12] Another study suggested that the ridges followed lines of greatest convexity in the embryonic epidermis.[13]

In another study authors have summarized present knowledge concerning the induction of the glandular folds and in turn the formation of epidermal ridges. Based on previous observations and their own studies they pointed out the regularity in the arrangement of the blood vessel and nerve pairs under the smooth epidermis corium border. This situation exits shortly before formation of glandular folds. They postulated that, the folds are induced by the vessel-nerve pairs. Other factors that may influence epidermal ridge pattern include inadequate supply of oxygen to the tissues, deviations in the proliferation of the epithelial basal layer and disturbances in keratinization of epithelium. Even environmental factors such as external pressure on the foetal pads and perhaps embryonic movements, particularly finger movement, can influence ridge formation.[14]

Methods of recording dermatoglyphics

A number of methods for recording dermatoglyphics exist. The methods vary in their requirements for equipments, time and experience and in the quality of prints produced.

Dermatoglyphic patterns are usually recognizable by the naked eye. A simple magnifying lens, preferably with a light source, helps greatly in scanning dermatoglyphics, especially in infants and small children whose patterns are very fine. Permanent impressions or prints are necessary for quantitative analysis of dermatoglyphics.

To enhance the quality of dermatoglyphic prints it is necessary to remove sweat, oil and dirt from skin. This can be accomplished by washing the ridged areas with soap and water and with ethyl alcohol or ether.

Care must be taken to print the ridged areas completely. The ridges are primarily on the volar surface but also pass upwards and along the lateral margins of the fingers, palm, toes and soles. Therefore a print of only the volar surface may be incomplete and it is often necessary to roll the digits, palms and soles to ensure obtaining a print of the whole pattern. Palm prints must include, the area from the distal crease of the wrist to the metacarpo-phalangeal creases, and complete printing of both ulnar and radial sides of the ridged areas must be assured. Very fine ridges may be accentuated by a colouring agent, such as ink from felt pens.[2]

Standard methods

All the methods are relatively easy to use, rapid and inexpensive. However, they vary in the quality of the prints obtained. One of the following methods may be used.

Ink method

This is the most widely used method. The necessary equipment consists of printer's ink, a roller, a glass or metal inking slab, a sponge rubber and good quality paper preferably with a slightly glazed surface. It is not suitable for use with uncooperative children and those with very fine ridges. The prints obtained by this method are not always of sufficiently good quality to allow accurate counting of ridges.[2]

Inkless method

This method makes use of a commercially available patented solution and specially treated sensitized paper. It was described in detail by Walker. It is not popular currently. The method is suitable for printing hands or feet with well demarcated dermal patterns.[15]

Transparent adhesive tape method

In this method, the print is produced by applying a dry colouring pigment to the skin and lifting it off with the transparent adhesive tape. The colouring agent may be coloured chalk, dust, India ink, standard ink, carbon paper, graphite stick or powdered graphite, common oil pastel crayon etc. This method is inexpensive, rapid and easy to use with all types of patients.

Prints are clear and not smudged. They can be preserved for an indefinite period of time.[2]

Special methods

These methods are not widely used. However, they may have some advantages over the standard methods, such as allowing the study of correlation between the epidermal patterns and the underlying bone structures (radiodermatography), study of sweat pores (hygrophotography) or study of the spatial shape of the ridged skin areas, for example in primates (plastic mold method).

Researchers have developed a method wherein, the region to be investigated is blackened with graphite smeared on a piece of cardboard. The print is taken by the Tesa film and then adhered to a transparent film strip or photo printing foil. Such a negative could be enlarged five or six times. An apparatus has been developed which can take finger and palm prints without any linking and automatically count ridge numbers between two prints.[2]

General features of ridge arrangement on palms

On examining a palm print, it can be seen that the ridges form nearly parallel rows. Their course is never straight, except in a very small area of skin. On both palms and soles, the ridges run in different directions in the various areas. At the junction of these ridge systems, three ridges meet to form a triradiate pattern, generally termed triradius (Figure No. 1). In the distal palm there are the digital triradii, called a, b, c, d (Figure No. 2), ‘a’ is situated proximal to the index finger, b, c, and d are located proximal to the middle, ring

and little fingers, respectively. Normally there is another triradius (t), situated at the proximal end of palm. Not frequently, a number of triradii other than those mentioned above are found in the distal palm. Two triradii may be fused into a single triradius or there may be an additional (accessory) triradii in some of the interdigital areas. A special case of a missing triradius is an interdigital triradius, which may subtend two or more digits. Such a triradius lying in the centre of an interdigital area is labeled in relation to the triradii it replaces, for example b and c for a triradius in the third interdigital area, between the normally formed triradii b and c.

Occasionally one of the triradius may be absent. In certain areas the ridges may be arranged to form patterns and triradii may be associated with these designs. By marking the ridges running from each triradius, a picture of the chief features of ridge arrangement is obtained. In this manner, the outlines of finger patterns can be traced from the triradii and these provide skeletons of the patterns. An accessory triradius can be observed in an interdigital area and these are referred to as a^1, b^1 c^1 and d^1. In definite areas the sites of the foetal volar pads, ridges may be arranged to form patterns. There are five of these areas on the palm (Figure No. 3); the thenar area under the thumb which usually includes the first interdigital area; the second, third and fourth interdigital areas; and the hypothenar area on the ulnar side of the palm.[16]

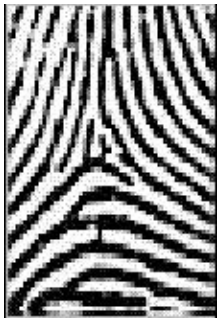


Figure No. 1: Triradius

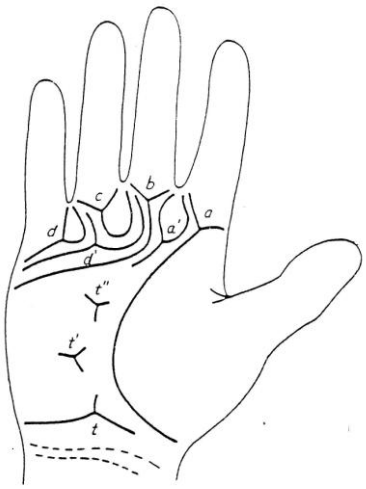


Figure No. 2: Palmar triradii a, b, c, d and t

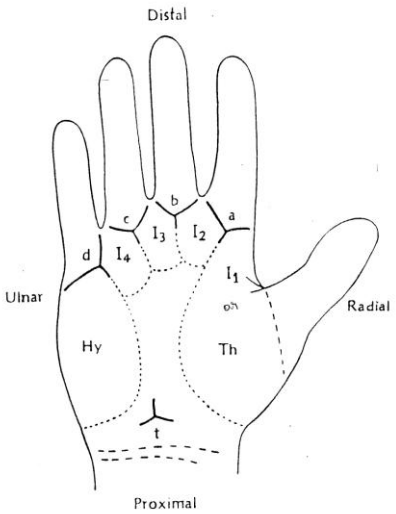


Figure No. 3: Palmar dermatoglyphic pattern areas

Finger patterns

Galton classified finger tip patterns into three main types, depending on the number of triradii present.

Arch

The simplest pattern to be found on the fingertips. It has no triradius. It is subdivided into two types. Simple (plain) arch and tented arch (T or At) (Figure No. 4, Photograph No. 1).

Loop

Loop is the most common pattern on the fingertip. It has one triradius. It is of two types. If the ridge opens on the ulnar side the resulting loop is termed an ulnar loop (UL) (Figure No. 5, Photograph No. 2) whereas, if it opens towards the radial margin it is called a radial loop (RL).

Whorl (W)

Whorl is the any ridge configuration with two or more triradii. There are different types of whorls – concentric whorl (Wc), spiral whorl (Ws), central pocket whorl (Wcp), double loop pattern (Wdl), etc. (Figure No. 6, Photograph No. 3). A person may have the same pattern on all ten fingers, but various patterns often occur on different digits.[4]

Figure No. 4: Simple arch and tented arch

Figure No. 5: Loop

Figure No. 6: Double loop whorl and spiral whorl

Palmar Patterns

Patterns on palms are similar to those on fingers, but usually larger and sometimes more complex. Thus, in the hypothenar area the principal patterns are loops of various types, including S-shaped pattern made up of double loops and whorls, often with three triradii. Thenar patterns are frequently distinctive incorporating loops, with some ridges running at right angles to the general ridge direction in the area. Interdigital patterns are almost invariably loops opening into the nearest interdigital space. Rarely very small whorls are found in this part of the palm. Pattern frequencies in all areas differ in the two sexes. For example on fingers, females have more arches and fewer whorls than males.[2]

The characteristics of dermatoglyphics can be described quantitatively that is by counting the number of ridges within a pattern and measuring angles or distance between specified points of triradii.[2]

The total finger ridge count (TFRC) represents the sum of the ridge counts of all ten fingers where only larger count is used on those digits with more than one ridge count. In a loop there is one triradius so one count; in a whorl with two triradii, there are two counts and higher is used. For a arch the score is zero. In a double loop whorl the counting is done from the triradii to the core that is nearer to the triradius.

Thus two counts – a radial and an ulnar are obtained Weninger proposed improvement of ridge counting in a bicentric pattern by adding the ridge numbers between the two cores to the conventional count. An absolute finger ridge count (AFRC) is the sum of the ridge counts from all the separate triradii on the fingers.

The TFRC and the AFRC are the same if no whorls are present, the TFRC expresses the size of pattern and the AFRC reflects the pattern size as well as its intensity.[17]

A study in 1961 illustrated that the mean ridge count of loop may be considerably lower than that of whorls in both males and females. A ridge count of 'zero' implies the presence of a simple or tented arch in the finger. Pattern intensity refers to the complexity of ridge configurations. It can be expressed by counting the number of triradii present.[2]

The most widely used method to interpret the position of axial triradius in the palm is the atd angle (Figure No. 7). This angle is formed by lines drawn from the digital triradius 'a' to axial triradius and to digital triradius 'd'. The symbol 't' is reserved for axial triradii found in the proximal region of palm, near the wrist crease. A triradius situated near the centre of palm is termed 't^{II}'. The symbol 't^{I}' represents the intermediate position of the triradius. An extremely distally placed triradius (distal to proximal transverse crease) is termed as 't^{III}'. The more distal the position of the axial triradius the larger the atd angle. The axial triradius shifted towards the radial side is called 'tr' and that situated nearer to the ulnar side is called 'tu'. Palms with pattern in hypothenar area may have more than one axial triradius. In such cases it is customary to record the widest atd angle i.e. the angle from the distal 't'. There are several disadvantages in using the atd angle as a dermatoglyphic parameter. The most important one is that the atd angle tends to decrease with age because the palm grows more in length than breadth. The size of the angle is also affected by the amount of spreading of the fingers when the patterns are printed. The pressure exerted while

the palm is printed also can affect the atd angle. The numerical values of the atd angles have been employed in determining the axial triradius positions, that is to distinguish between t and t^{I}. t^{I} and t^{II}. Penrose suggested that an angle less than 45˚ be designated as t, angles between 45˚ and 56˚ as t^{I}, any larger angles as t^{II}. Cripel considered 61˚ as t^{II}. Cascos considered 71˚ as t^{II} [18] and Preus and Fraser considered 63˚ as t^{II}.[19]

Flexion creases – palm and fingers

These creases represent the location of the firmer attachment of the skin to underlying structures. The first to appear is the radial longitudinal crease that borders the thenar eminence. This is followed by the proximal transverse crease (PTC), and distal transverse crease (Figure No. 8). Sometimes the proximal and distal transverse creases are replaced by or joined into one single crease that traverses the whole palm. This single transverse flexion crease is usually referred to as a simian crease or line (Figure No. 9). Variants of single palmar crease have been noted (Figure No 10). They are transitional type 1 (proximal and distal creases connected by a bridging crease) and transitional type 2 (fusion of the transverse creases with branching proximal and distal segments, incomplete single palmar crease). A variation in appearance of PTC is the Sydney line (SL) (Figure No. 11) after the city in Australia where it was observed first. SL represents PTC extending beyond hypothenar eminence to the ulnar margin of the palm. The distal transverse crease persists and that appears normal.[20]

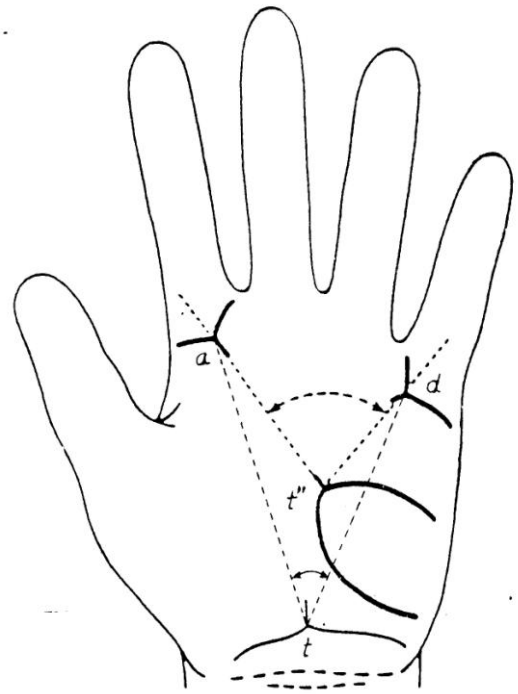


Figure No. 7: Maximal and minimal atd angles

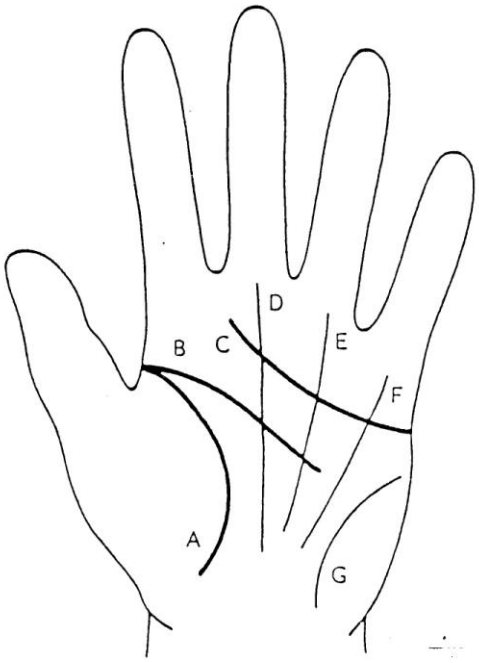


Figure No. 8: Normal flexion creases

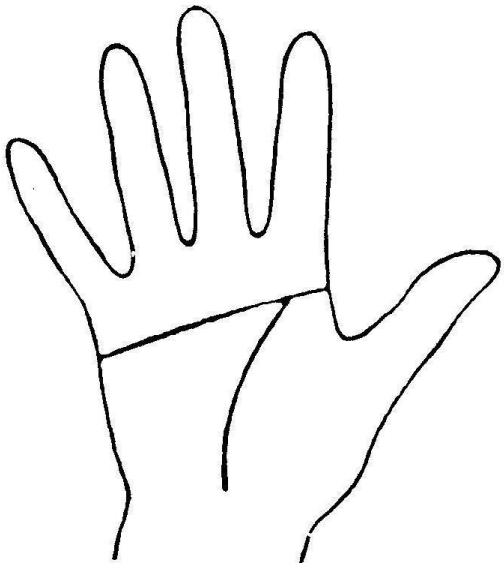


Figure No. 9: Single flexion crease

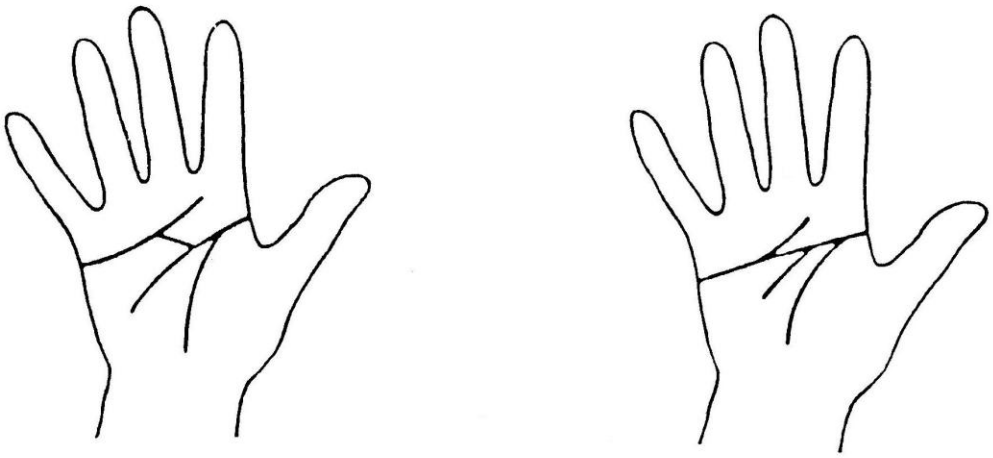


Figure No. 10: Simian transitional type-I and type-II

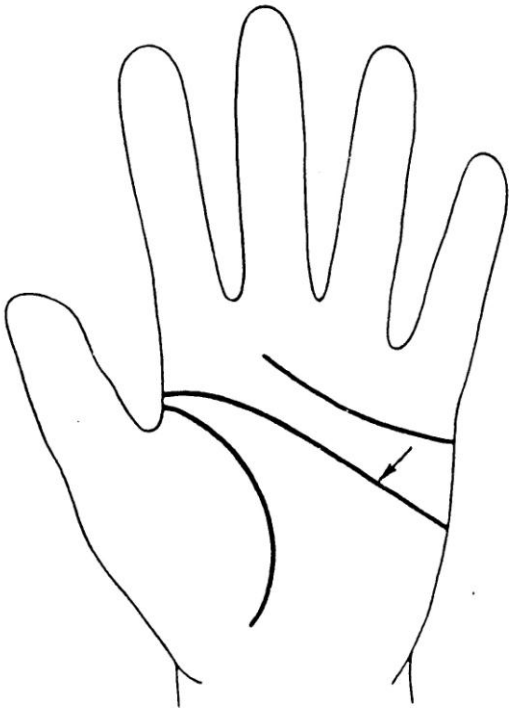


Figure No. 11: Sydney line

Inheritance of dermatoglyphic traits

Studies have shown that total finger ridge count follows polygenic mode of inheritance.[21] Scientists opine that, the total ridge count, in spite of its continuous variations, is the sum of a heterogenous combination of values (fingers with different means, standard deviations and frequency distributions) with complicated interrelations. Such a heterogenous term cannot pass for a homogenous biologically meaningful character.[17] A single major autosomal locus with two additive alleles may account for over half the variations of the quantitative phenotype absolute finger ridge count.[22]

By measurement of the maximal atd angle on palms, it has been shown that the position of the axial triradius is determined by heredity. The size of the ridge count between the palmar triradii 'a' and 'b' has also been shown to be genetically controlled. It appears, however, that palmar ridge assessments are affected to a greater extent by environmental influence than finger patterns; nevertheless they have a strong hereditary component. Ridge counts are not affected by age, since a difference in palm size exists between the sexes, and angle varies with sex.[21]

Considering the high heritability of finger ridge pattern, intensifying the factor structure for finger patterns, may be to a considerable degree, a representative of interaction, between non-allelic genes in polygenic systems for individual fingers, favoured by natural selection.[12]

Dermatoglyphic and developmental abnormalities

All variations in the counters of hands and feet are associated with some degree of dermatoglyphic distortion. It is now well established that, growth disturbances in the fetus, whatever their origin, are liable to distort the alignment of dermal ridges. Anomalous configurations result when disturbances involve hands and feet at the time of ridge formation during the third and fourth prenatal months. Abnormalities in the growth process may result from action of abnormal genes, from chromosomal aberrations, from poisoning by a drug, or from a viral infection. In some cases, the cause remains unknown.[16] If we examine various prints and find characteristic patterns in individuals that differ from the normal, their abnormalities must have been caused by changes occurring before the

completion of fourth fetal month. Since after the 17th intrauterine week, the dermatoglyphic pattern remains unchanged throughout life, this becomes the only time when the ridges are subjected to alteration. Despite pathology after the fourth intrauterine month, the dermatoglyphic pattern remains unchanged throughout life. Thus, abnormalities in the epidermal ridges must result from either genetic disease or fetal pathology occurring sometime around the first trimester. Usually such changes would most likely, occur during the organogenic period, between day 13 and day 60, after fertilization.[23]

Historical Review of Epilepsy

It is learnt that, epilepsy has been known for at least 3000 years. Basic concepts surrounding epilepsy in ancient Indian medicine were refined and developed during the Vedic period of 4500 to 1500 BC. In the Ayurvedic literature of Charaka Samhita (which dates to 400 BC the oldest existing description of the complete Ayurvedic medical system), epilepsy is described as '*apasmara*' which means 'loss of consciousness'. The Charaka Samhita contains abundant references to all aspects of epilepsy including symptomatology, aetiology, diagnosis and treatment.

Another ancient and detailed account of epilepsy is on a Babylonian tablet in the British Museum in London. This is a chapter from a Babylonian textbook of medicine comprising 40 tablets dating as far back as 1067 BC. The tablet accurately records many of the different seizure types we recognize today. In contrast to the Ayurvedic medicine of Charaka Samhita, however, it emphasizes

the supernatural nature of epilepsy, with each seizure type associated with the name of a spirit or god usually evil.

Diagnosis posed problems for the ancients just as it does today. The Greek physician Alexandros of Tralleis (525–605 BC) suggested: 'wash the head of the patient and burn a ram's horn under his nose and he will fall down'. (In ancient times, the goat was considered the mammal that was most prone to epileptic seizures.) In Roman times, people suspected of epilepsy were given a piece of jet to smell. If the person did not fall to the ground on smelling the stone, he was considered 'free of the falling sickness'. (This was a common procedure when buying slaves).

Although Hippocrates (c. 400 BC) and his followers regarded it as a physical disorder due to natural causes, only in the 19^{th} and 20^{th} centuries have rational and scientific notions replaced primitive concepts of the medical Dark Age. Galen of Pergamon (AD 130 to 200) performed no autopsies but described three types of fits, and deduced that epilepsy was a brain disorder related to an accumulation of thick humours. Galen says the moon governs the periods of epileptic cases; hence, Greeks and Romans often regarded them as lunatics.

The term 'sacred disease' had been used ironically, since the disorder was anything but sacred in its nature. It was simply a physical illness and not the product of some supernatural intervention. But this is a minor example of contemporary speculation of how our forefathers might have thought about illness. In times when scientific ignorance commonly caused invocations of the

deity or the supernatural, the term sacred disease may at times have been intended literally.[24]

Genetics of Epilepsy

Literatures on genetics of epilepsy yield ranges of conclusions like the incidence of epilepsy is not increased in families of affected individuals, and generally epilepsy is inherited as an autosomal dominant trait. This disparity is the result of many causes of seizures, their episodic occurrence and varying types of patients studied.[25]

There is a strong familial component of epilepsy that is not attributable to shared environmental causes. Studies of the family members of affected individuals show about 2.5 fold increased risk of epilepsy in siblings of affected individuals.[26]

A study showed an approximate 4% risk for epilepsy through age 20 and a 10% risk for any type of seizure disorder. Studies of children of parents with epilepsy had shown that offsprings of mother with epilepsy were at greater risk than those of fathers with epilepsy.[27]

Presumably, genetically related types of epilepsy are primary generalized tonic clonic seizures, progressive myoclonic epilepsy, some childhood absence seizures, etc. Except for relative rare Mendelian traits that encompass seizure disorders, epilepsy does not follow single gene mechanism of inheritance.[28]

Unlike many presumed autoimmune disorders, strong HLA markers have not been established for epilepsy. Linkage to specific chromosomes has been reported in some families with benign familial neonatal seizures on long arm of chromosome 20[29] and with juvenile myoclonic epilepsy on short arm of chromosome 6.[30]

Dermatoglyphics in epilepsy

A study done on dermatoglyphic features, type, course and pathogenic forms of epilepsy revealed certain diagnostical and prognostical value. [31]

Another study was undertaken for dermatoglyphic prints in 100 male cacucasians with confirmed diagnosis of convulsive disorders.[32]

The dermatoglyphic data was taken for the study to provide information for the theory of genetic issues in epilepsy, which is important for medical genetic consultation.[33]

METHODOLOGY

The present study was conducted in the Department of Anatomy during the period from January 2007 to December 2007.

Study Design

Cross sectional study.

Study period

The present one year study was conducted from January-2007 to December 2007.

Method of collection of data

Source of Data

The material for the study consisted of finger and palm prints of patients selected from those attending out patient Department of Neuromedicine, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum, aged between 5 and 40 years. The controls were normal mixed population with same age and sex matched.

Sample size

Study consists of 140 subjects categorized into two groups.

70 patients with epilepsy (35 males, 35 females)

70 normal individuals (control groups) (35 males, 35 females)

Sampling procedure

The sample size was calculated considering 80% of the average cases attending to Department of Neuromedicine, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum over a period of three years.

Selection Criteria

Inclusion Criteria

- Patients with history of epilepsy.
- Age ranging from 5 to 40 years.

Exclusion Criteria

- Other diseases like diabetes mellitus, schizophenia, Down's syndrome etc. causing dermatoglyphic changes were excluded.

Data Collection

Permission was obtained from Head of the Department of Neuromedicine of KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum to conduct the study. Patients were informed about the procedure in detail and their consent (Annexure I) was obtained. The data like age, sex, address, history of illness and other medical history of importance were obtained by interviewing the patients and recorded on predesigned and pretested proforma (Annexure II).

Among the various number of methods used for recording dermatoglyphics, the most routinely used one that is the ink method was used for this study.

The materials used were simple (Photograph No. 5). They were black duplicating ink (Kores, Bombay), printing card, roller, inking slab, pressure pad, kerosene, alcohol, soap (cleaning agents) and simple magnifying lens.

Subjects were asked to wash their hands with soap water, so as to remove any oil or dirt. Ink was smeared on their hands using a roller. Ink slab and surface to be printed were prepared. First the prints of fingertips were taken followed by that of palm, on the paper kept over the table (Photograph No. 4, 6, 7).

The finger and palm prints were analyzed qualitatively and quantitatively. The qualitative analysis done included the finger print patterns and palmar patterns.

The quantitative analysis done included total finger ridge count and atd angles.

Qualitative analysis

To analyze finger pattern frequency, the fingertip pattern configurations were classified as arches (A), loops (L) and whorls (W).

Loops were recorded as ulnar or radial depending on the side on which they opened and whorls were recorded as true and composite (w comp) whorls.

To study palmar pattern configurations, parameters chosen were patterns in thenar /I_1, I_2, I_3 and I_4 triradii when present were recorded.

Quantitative analysis

The characteristics of dermatoglyphics can be described quantitatively that is by counting the number of ridges within a pattern and measuring angles or distance between specified points of triradii.

The counting was done along a straight line connecting the triradii point to the point of core (Figure No. 12). Symbols and ridge counts were recorded in order, beginning from first digit of right hand to the fifth digit and from first digit of left hand to fifth digit of same hand. The total finger ridge count (TFR) was derived by adding the ridge counts on all ten fingers. Only the large count was used on those digits with more than one ridge count. In a loop there is one triradius and so one side ridge count; in a whorl with two triradii there are two side counts and higher is used. For an arch the score is zero.

Loop **Simple whorl** **Composite whorl**

Figure No. 12: Method of counting finger ridges

The atd angle was recorded by drawing lines from the digital triradius ‘a’ to the axial triradius ‘t’ and from this to the digital triradius ‘d’. In palms with more than one axial triradius, the atd angle originating from each axial triradius was measured.

Statistical analysis

For quantitative analysis the arithmetic mean, standard deviation and critical values were calculated.

Critical rate = $X_1 – X_2$ / S. E. $(X_1 – X_2)$

X_1 and X_2 are means of two groups and S. E. $(X_1 - X_2)$ is the standard error of the difference between X_1 and X_2 which is given by the formula,

Standard Error $(X_1 – X_2) = \sqrt{(SD_1^2 / n_1) + (SD_2^2 / n_2)}$

Where, SD_1 and SD_2 are standard deviations and n_1 and n_2 are sample size.

For qualitative analysis chi square test was applied.

RESULTS

In the present study after taking finger prints of all 140 individuals, following observations were made. Finger print patterns were observed. They were categorized into following types.

1. Arches
2. Ulnar loops
3. Radial loops
4. Whorls

In order to find out the frequency of finger tip print patterns of both hands that is all ten fingers of an individual were considered together. Palmar patterns were observed in different areas of palm such as hypothenar, thenar/I_1, I_2, I_3 and I_4 areas. Various patterns encountered in both hands were noted down. The frequency of palmar patterns in the above mentioned areas was calculated in both hands separately. Total finger ridge count was calculated by taking its mean. The values were compared between different groups.

Finally atd angles were measured in both hands. Their mean was taken and observations obtained were tabulated taking both hands separately. Separate tables were prepared for individual dermatoglyphic parameters observed. 'p' value was calculated and results obtained were tested for statistical significance. 70 patients suffering from epilepsy were considered as cases (35 males, 35 females). 70 normal individuals were considered as controls (35 males, 35 females).

Table No. 1. Finger print patterns of males and females in both the study groups

Pattern		Controls (n = 35)		Patients (n = 35)	
		Male	**Female**	**Male**	**Female**
Loops	**Ulnar**	53.2%	61.2%	55.2%	60.4%
	Radial	1.2%	1.4%	3.6%	1.6%
Arch		2.8%	4.6%	3.8%	4.0%
Whorls		42.8%	32.8%	37.4%	34.0%

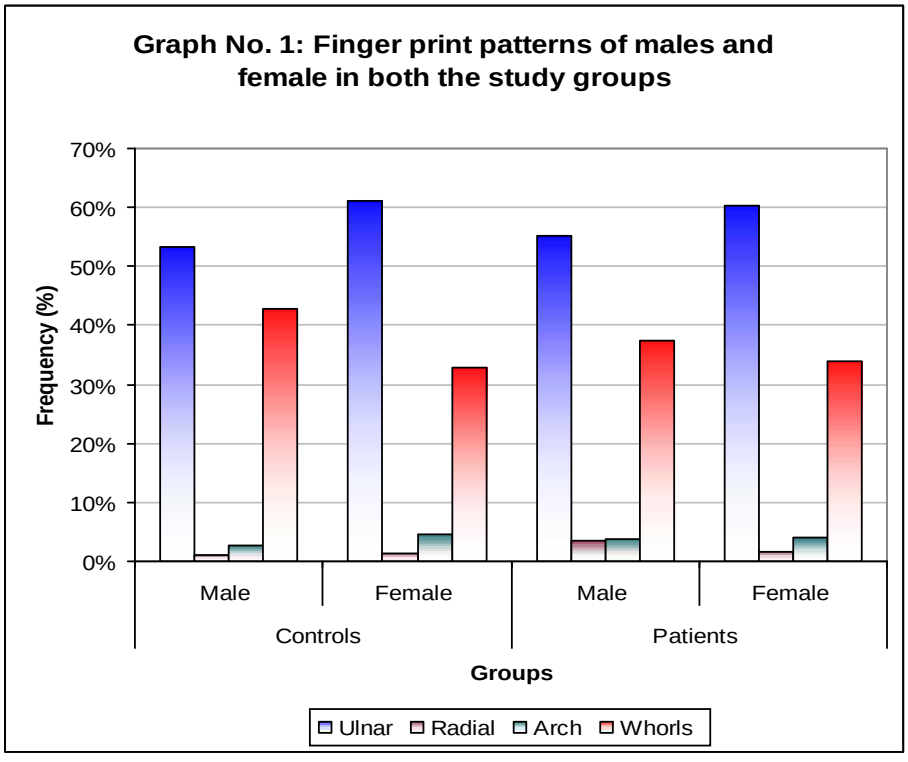


Table No. 1 shows that the difference in frequencies of pattern distribution in male controls and patients is significant (x^2 = 8.759, p < 0.050). Whereas, the frequencies of pattern in female controls and patients are not statistically significant (x^2 = 0.410, p > 0.050).

Table No. 2: Percentage of digitwise frequency in male controls (n = 35)

Digit	Pattern			
	Ulnar loop	**Radial loop**	**Arch**	**Whorl**
R_1	40	02	02	56
R_2	44	02	08	46
R_3	72	00	04	24
R_4	28	00	02	70
R_5	66	00	00	34
L_1	52	02	02	44
L_2	46	06	04	44
L_3	74	00	02	24
L_4	30	00	02	68
L_5	80	00	02	18

Table No. 3: Percentage of digitwise frequency in male patients (n = 35)

Digit	Pattern			
	Ulnar loop	**Radial loop**	**Arch**	**Whorl**
R_1	56	00	02	42
R_2	40	16	08	36
R_3	72	02	04	22
R_4	38	02	02	48
R_5	68	02	02	28
L_1	52	00	04	44
L_2	36	12	08	44
L_3	72	00	04	24
L_4	44	02	02	52
L_5	74	00	02	24

Table No.2 and 3 show that ulnar loops are increased in epilepsy on R_4, L_4 and R_1 and decreased on L_2, L_5. Radial loops were increased in epilepsy on R_2 which was statistically significant (x^2 = 4.400; p < 0.050). Also radial loops are increased in epilepsy on L_2. Arches are increased in epilepsy on L_1, L_2 L_3. Whorls are decreased in epilepsy on R_1, R_2, R_4 and L_4. Whorls are increased in epilepsy on L_5.

Table No. 4: Percentage of digitwise frequency of pattern in female controls (n = 35)

Digit	Pattern			
	Ulnar loop	**Radial loop**	**Arch**	**Whorl**
R_1	56	00	02	42
R_2	50	06	08	36
R_3	80	00	02	18
R_4	42	00	02	56
R_5	88	00	02	10
L_1	56	00	06	38
L_2	46	04	16	34
L_3	70	02	04	24
L_4	46	02	02	50
L_5	78	00	02	20

Table No. 5: Percentage of digitwise frequency of pattern in female patients (n = 35)

Digit	Pattern			
	Ulnar loop	**Radial loop**	**Arch**	**Whorl**
R_1	64	00	02	34
R_2	52	04	06	38
R_3	74	02	06	18
R_4	40	02	00	48
R_5	88	00	00	12
L_1	54	02	02	42
L_2	44	06	10	40
L_3	62	00	10	28
L_4	44	00	02	54
L_5	82	00	02	16

Table 4 and 5 show that, ulnar loops are increased in epilepsy on R_1 and L_5 and decreased on L_3. Radial loops are not showing significant changes in control and patients. Arches are increased in epilepsy on R_3 and L_3 but are decreased on L_2. Whorls are increased in epilepsy on L_2 and are decreased on R_1. However all these differences are not statistically significant.

Table No. 6: Hypothenar pattern frequency of males and females in both the study groups

Groups	Males		Females	
	Right Hand	**Left Hand**	**Right Hand**	**Left Hand**
Control (n=35)	16.0%	12.0%	24.0%	18.0%
Patient (n=35)	24.0%	18.0%	12.0%	8.0%
x^2 value	0.562	0.313	1.693	1.140
p value	> 0.05	> 0.05	> 0.05	> 0.05

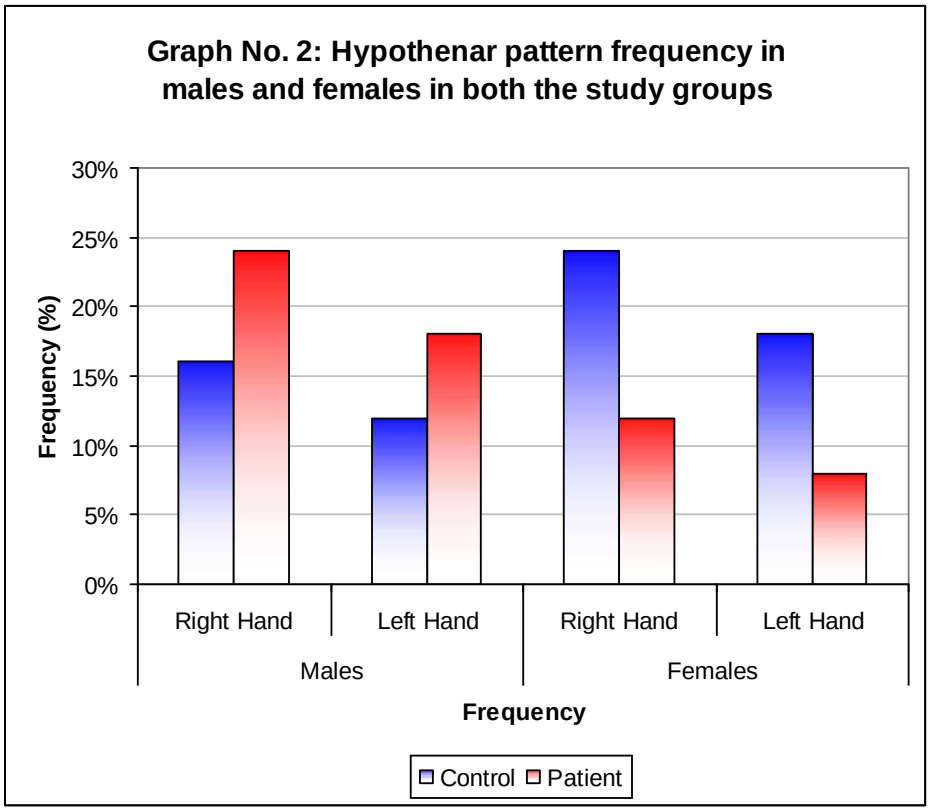
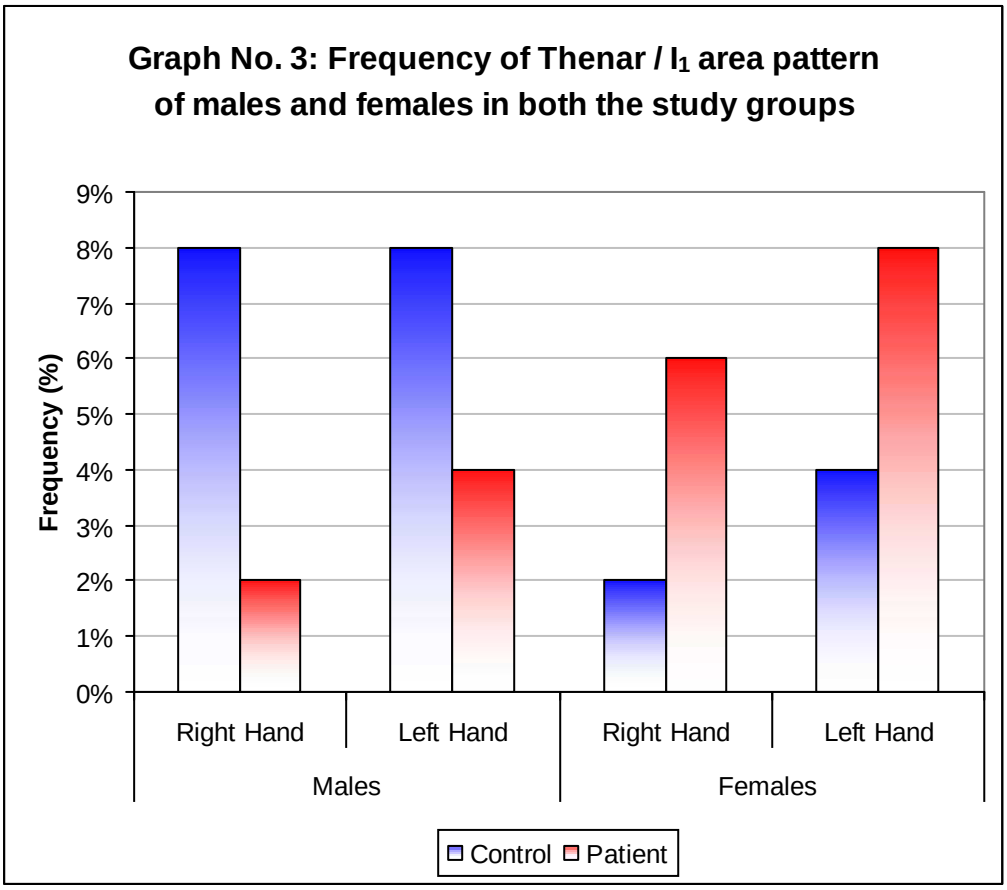


Table No. 6 shows that frequencies of hyothenar pattern in male epileptic patients is more as compared to controls in both hands. This difference is statistically not significant. The frequencies of hypothenar pattern in female epileptic patients is less as compared to controls in both hands. This difference was statistically not significant.

Table No. 7: Frequency of Thenar / I_1 area pattern of males and females in both the study groups

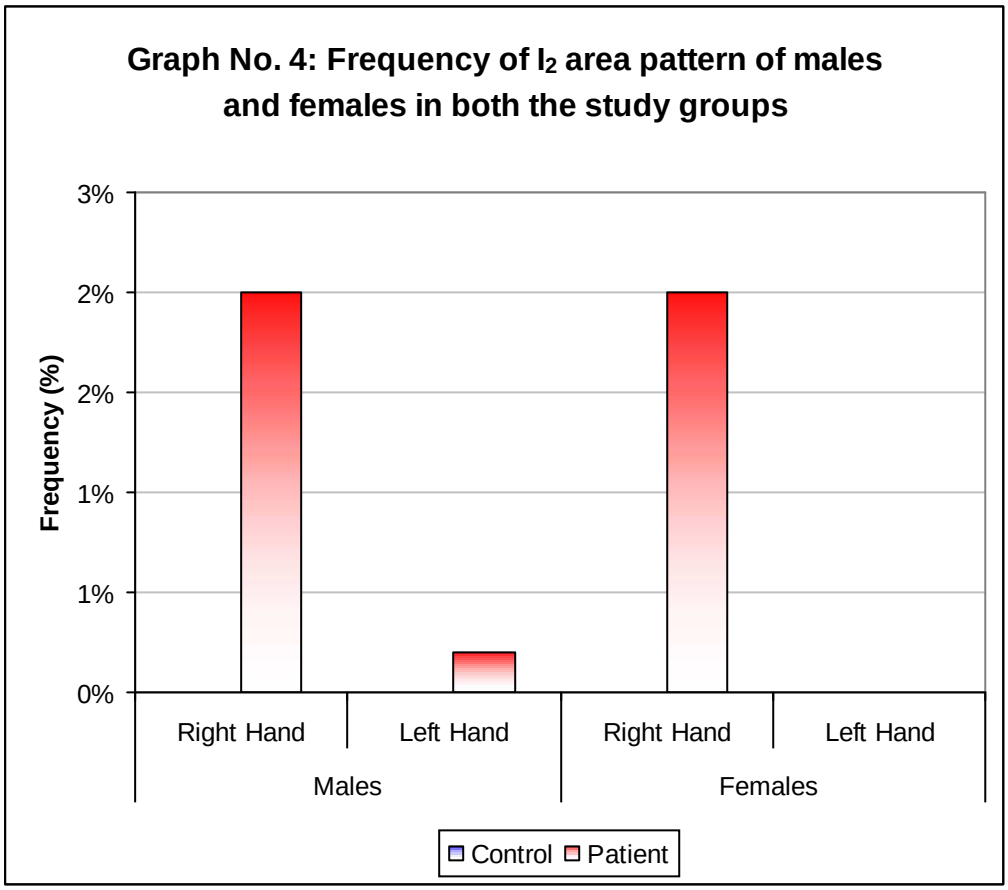
Groups	Males		Females	
	Right Hand	Left Hand	Right Hand	Left Hand
Control (n=35)	8.0%	8.0%	2.0%	4.0%
Patient (n=35)	2.0%	4.0%	6.0%	8.0%
x^2 value	0.8421	0.1773	0.260	0.177
p value	> 0.05	> 0.05	> 0.05	> 0.05



The above table shows that frequency of occurrence of thenar I_1, in male epileptic patients is less compared to control and in female epileptic patients is more as compared to controls. This difference was statistically not significant.

Table No. 8: Frequency of I_2 area pattern of males and females in both the study groups.

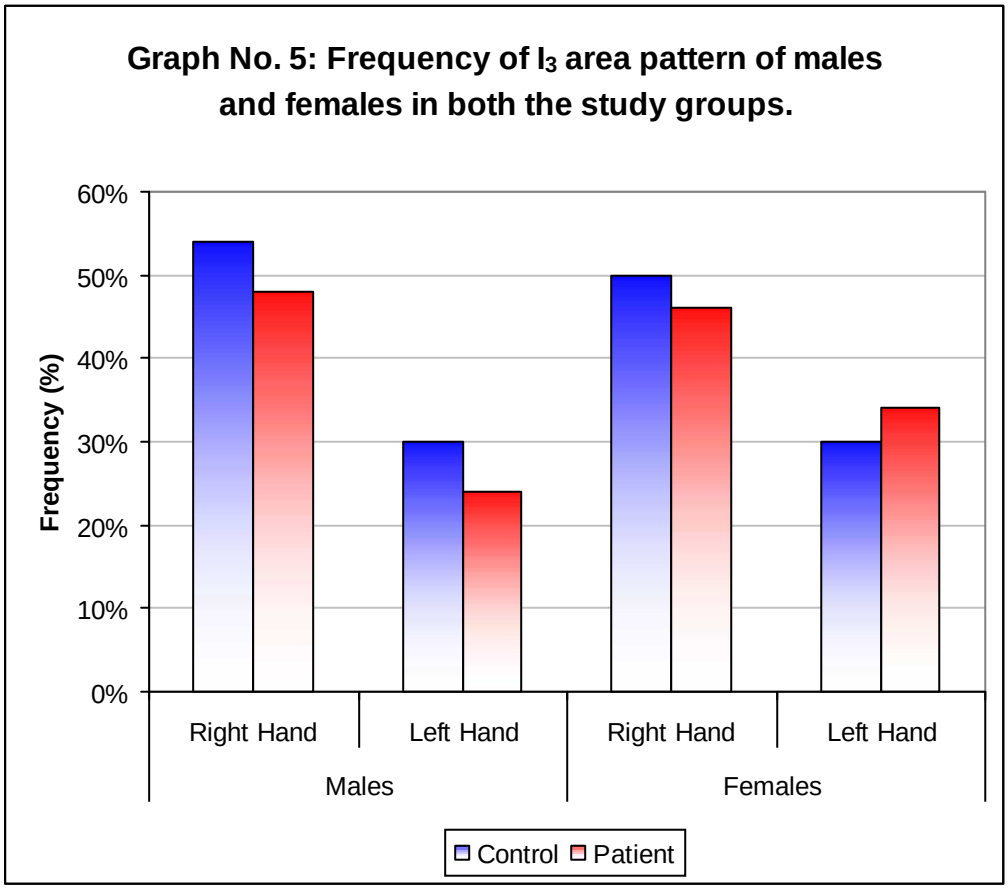
Groups	Males		Females	
	Right Hand	**Left Hand**	**Right Hand**	**Left Hand**
Control (n=35)	0.0%	0.0%	0.0%	0.0%
Patient (n=35)	2.0%	0.2%	2.0%	0.0%
x^2 value	0.970	0.970	0.970	-
p value	> 0.05	> 0.05	> 0.05	> 0.05



The above table shows that the frequency of pattern occurrence of I_2 in males and females are not significant.

Table No. 9: Frequency of I_3 area pattern of males and females in both the study groups.

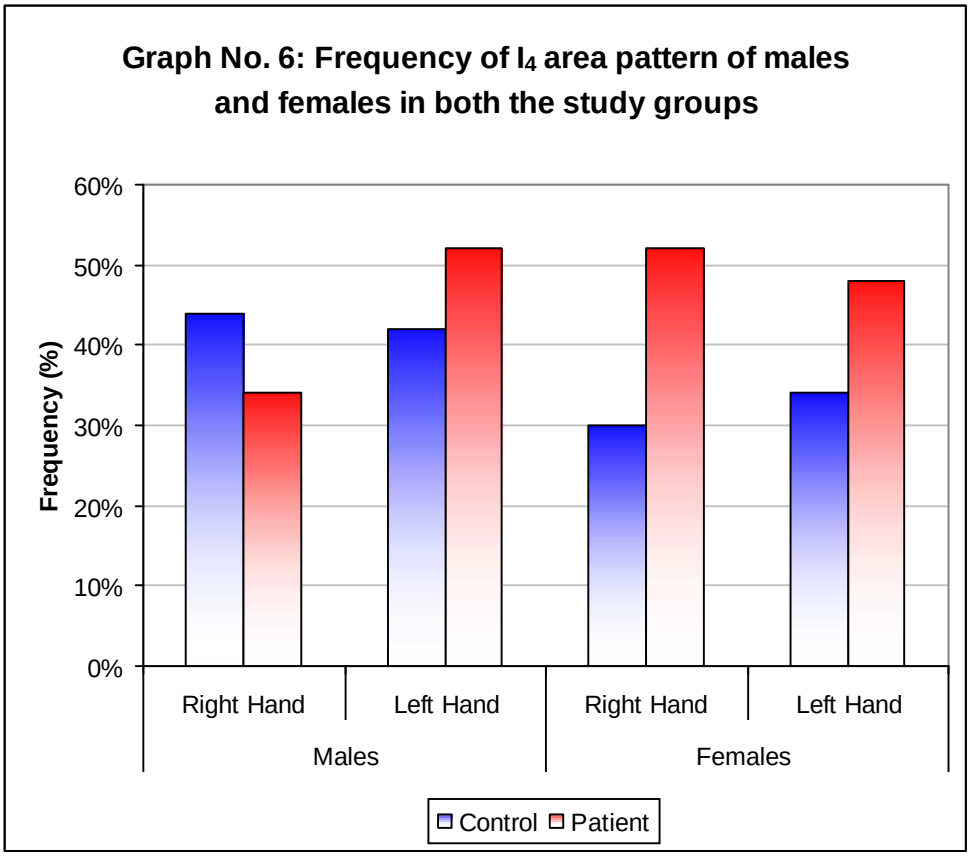
Groups	Males		Females	
	Right Hand	**Left Hand**	**Right Hand**	**Left Hand**
Control (n=35)	54.0%	30.0%	50.0%	30.0%
Patient (n=35)	48.0%	24.0%	46.0%	34.0%
x^2 value	0.640	0.200	0.040	0.040
p value	>0.05	>0.05	>0.05	>0.05



The above table shows that, the frequency occurrence of I_3 pattern in males patients are less as compared to controls and in female patients are less on right hand and more on left hand which is statistically not significant.

Table No. 10: Frequency of I_4 area pattern of males and females in both the study groups

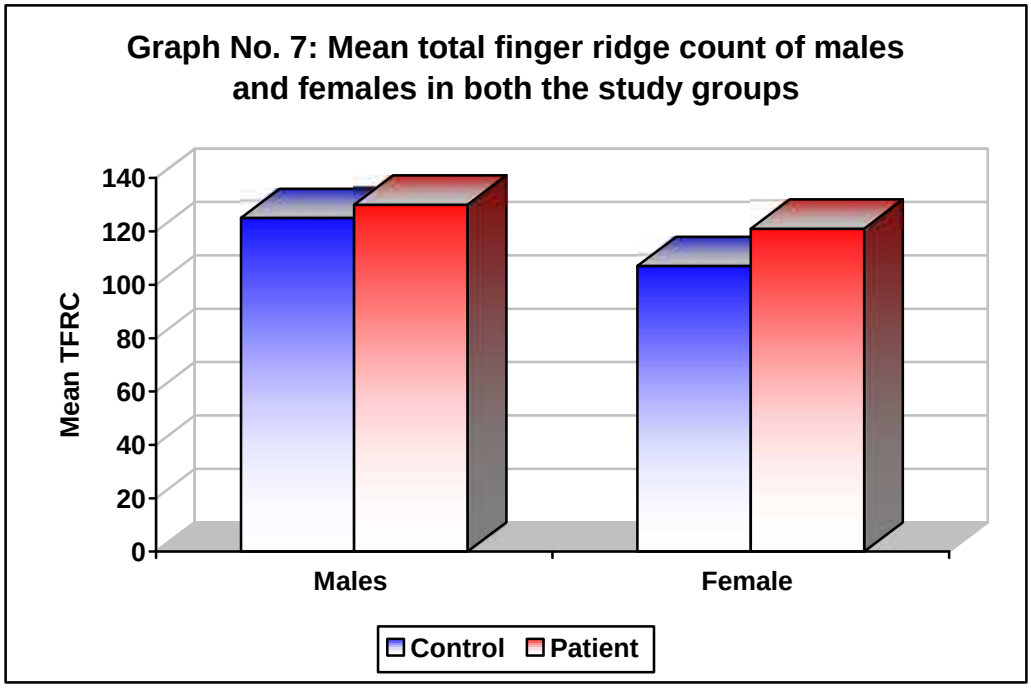
Groups	Males		Females	
	Right Hand	**Left Hand**	**Right Hand**	**Left Hand**
Control (n=35)	44.0%	42.0%	30.0%	34.0%
Patient (n=35)	34.0%	52.0%	52.0%	48.0%
x^2 value	0.670	0.360	4.133	4.871
p value	> 0.05	> 0.05	< 0.05	< 0.05



The above table shows that, in male patients on right hand occurrence of I_4 pattern is low, but on left hand it is more as compared to normal and the difference is statistically not significant. Female epileptic patients show higher frequency of I_4 pattern in both hands, which is statistically significant.

Table No. 11: Mean total finger ridge count of males and females in both the study groups.

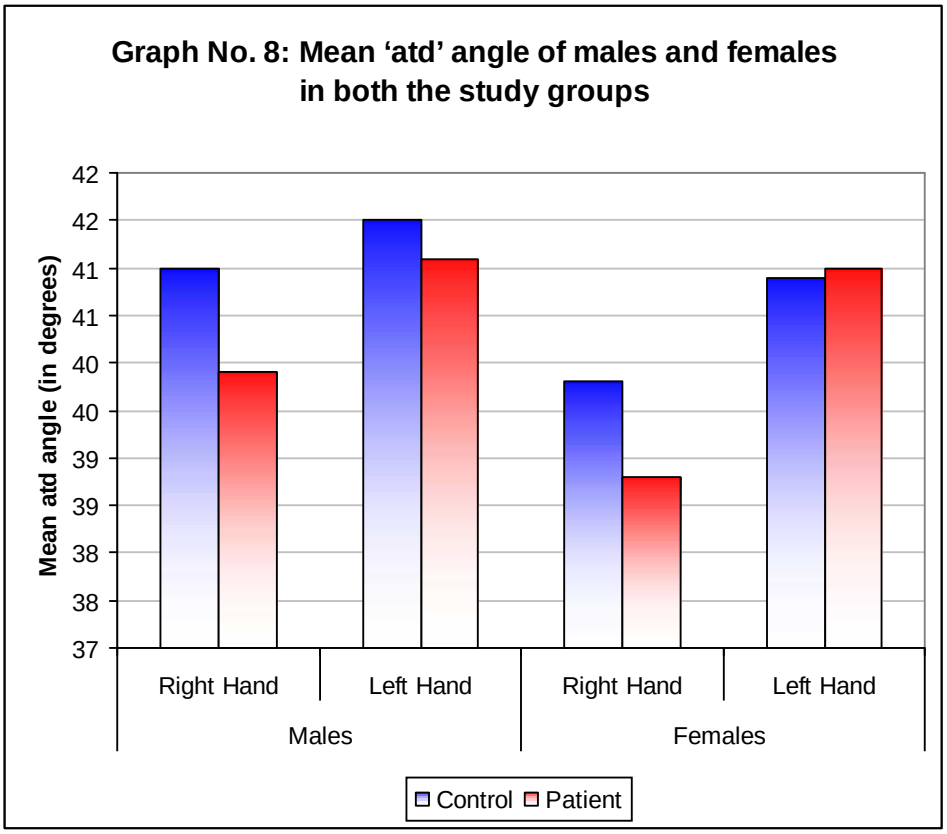
Groups	Mean TFRC			
	Males		Females	
	Mean	S.D	Mean	S.D.
Control (n=35)	125	8.18	107	5.74
Patient (n=35)	130	7.12	121	4.76
t value	2.73		11.88	
p value	< 0.05		< 0.05	



The above table shows that, male epileptic patients show higher mean total finger ridge count (130 ± 7.12) as compared to controls and difference is statistically significant (t = 2.73, p < 0.05). Female epileptic patients show higher mean total finger ridge count, which is statistically highly significant (t = 11.88, p <0.05). Mean and S. D. of TFRC and 'atd' angles were calculated for different groups. They were compared using 't' test. Significance level fixed at 0.05 level (p value).

Table No. 12: Mean 'atd' angle of males and females in both the study groups.

Groups	Mean atd angle (in degrees)							
	Males				Females			
	Rt. Hand		Lt. Hand		Rt. Hand		Lt. Hand	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Control (n=35)	41.0	5.3	41.5	4.89	39.8	2.80	40.9	1.74
Patient (n=35)	39.9	2.80	41.1	2.23	38.8	1.84	41.0	0.98
t value	1.01		0.47		1.67		0.17	
p value	> 0.05		> 0.05		> 0.05		> 0.05	



The above table shows that, the mean 'atd' angle in male and female epileptic patients on right and left hand does not differ significantly from controls.

DISCUSSION

The hypothesis that antenatal factors may be involved in the pathogenesis of a disorder which becomes apparent later in life, would be suggested if a relationship between a parental event such as dermal ridge formation and disorder could be established. Thus the dermal ridges have various notable characteristics which make them important not only in personal identification of a person but also in human biology for various reasons such as;

1. Unlike many bodily traits the dermal ridges and configuration once formed remain unchanged except in dimensions that are age stable.

2. The ridges are environment stable and begin to appear from fifth month of intra uterine life.

3. Although the patterns formed by ridges vary in size, shape and detailed structure still they can be classified into definite types.

A genetic theory assumes that the basic finger print pattern sequence is all ulnar loops and that various genes cause deviations from this pattern sequence.[34]

In recent past a number of investigators have focused their attention in finding out an association of morphological characters with a number of pathological conditions. It has been demonstrated by many that dermatoglyphics is of aid in the diagnosis and understanding the genetics of many human pathogenic abnormalities.[35]

A study in 1936 pointed out characteristic differences in dermatoglyphic features in patients with Down's syndrome compared to the normal population. The loops tend to be vertically oriented and L shaped and frequently found on all ten finger tips of patients. The hypothenar area shows an increased frequency of patterns. Many of the patterns are large and often terminated distally by a high axial triradius. As a result, significantly increased maximal 'atd' angles are commonly found. The thenar patterns in Down's syndrome were decreased in frequency, size and complexity.[36]

Another study revealed that the most typical dermatoglyphic finding was a strikingly high frequency of arches on the fingertips. The 'atd' angle was often increased. A study conducted on Trisomy 13 showed a marked increase of patterns in the thenar areas of the patients.[37]

A study conducted in the year 1972 identified dermatoglyphic characteristics (total finger ridge count, maximal atd angle, T line termination in I_2 area and presence of hypothenar patterns on the palms) which show significant differences in frequency between patients with Turner syndrome and normal females.[38]

In another study conducted in 1966 the author investigated the fingertips, I_3 area and hallucal patterns of 71 patients, 60 having cleft lip and palate three having cleft lip only and eight having cleft palate only. He found no significant differences in any dematoglyphic configurations between patients and controls.[39]

An analysis done in 1967 showed an increased asymmetry of atd angles in the group of patients with familial clef lip with or without cleft palate.[40]

A study reported an increased frequency of fingertip radial loops in males and of radial whorls in females with leukemia.[41]

Studies conducted in schizophrenia showed that there is increase in arch pattern in schizophrenic males than that of the control males.[10]

In a study conducted on dermatoglyphic parameters in 100 cases of essential hypertension in comparison to 15 healthy controls. They found no significant difference in digit patterns and a significant increase in total finger ridge count and absolute finger ridge count were noted. A decrease in the atd angle was observed in both the studies. They have reported absence of axial triradii in case of hypertensives as compared to controls in both sexes.[42]

A study in dermatoglyphic prints in 100 Caucasian males with confirmed diagnosis of convulsive disorders found significant differences compared to control.[32]

Other study had distinguished the correlations between dermatoglyphic features and a form of epilepsy, types of course and its pathogenic forms. Their data testified to certain diagnostical and prognostical value of dermatoglyphic features.[31]

The researchers suggested existence of genetic predisposition to seizures of various etiologies and some dermatoglyphic deviation in patients with epilepsy.[2]

Another study suggested that, dermatoglyphic data is an important for medical genetic consultation and provide information for the theory of genetic issues in epilepsy.[33]

In the present study the qualitative analysis of dermatoglyphic features revealed the following findings;

Frequency of the Finger print pattern

1. Ulnar loops

In the present study male epileptic patients showed higher frequency (55.2%) of ulnar loops as compared to controls (53.2%). Female epileptic patients showed slightly low frequency of ulanr loops (patients 60.4%, control 61.2%).

A study conducted on 100 male epileptic patients reported the presence of ulnar loops in 63% epileptic patients compared to 59.9% of control population.[32]

2. Radial loops

In male epileptic patients the frequency of radial loops was 3.6%, and in control it was 1.2%. The difference in the frequencies was statistically significant (x^2 = 6.633; $p < 0.05$). In female epileptic patients the frequency of radial loops was 1.6% and in female control it was 1.4%. The difference in frequencies of female epileptic patients and control is not statistically significant in the present study.

A study reported 6.6% frequency of radial loops in male epileptic patients and 5% in control patients.[32]

4. Arches

In the present study, the frequency of arches in male epileptic patients was 3.8% and in control it was 2.8% which indicates that there was increase in frequency of arches in male epileptic patients than control. The frequency of arches in epileptic female patients was 4% and in female control it was 4.6%.

A study showed that 4.8% frequency of arches in male epileptic patients compared to 1.7% in controls.[32]

5. Whorls

The frequency of whorls in male epileptic patients was low (37.0%) as compared to control (42.8%), which was statistically not significant. In female epileptic patient the frequency of whorl was 34% while in female control it was 32.8%. This indicates the frequency of whorls is slightly more in female epileptic patients as compared to control which was statistically not significant.

A study reported 25.6% frequency of whorls in epileptic male patients compared to 28.4% control population.[32]

From above observation it was seen that the arches, radial loops and ulnar loops have increased mainly at the cost of whorls in male epileptic patient. While in female epileptic patients, whorl and radial loops are showing marginal increase at the expense of other two that is arches and ulnar loops.

Digitwise frequency of male patients

- Ulnar loops are increased in epilepsy on R_4, L_4 and R_1, and decreased on L_2 and L_5.
- Radial loops showed statistically significantly increased in epilepsy on R_2 ($x^2 = 4.400$; $p < 0.05$) and also increased on L_2.
- Arches are increased in epilepsy on L_1, L_2, L_3.
- Whorls are decreased in epilepsy on R_1, R_2, R_4 and L_4, and are increased in epilepsy on L_5.

Digitwise frequency pattern in females

- Ulanr loops increased in epilepsy on R_1 and L_5, and are decreased on L_3.
- Radial loops are not showing significant change in controls and patients.
- Arches are increased in epilepsy on R_3 and L_3 but decreased on L_2.
- Whorls are increased in epilepsy on L_2 and are decreased on R_1.

  But these differences are not statistically significant.

Interdigital pattern

1. Thenar/I_1 pattern

Male epileptic patients showed lower frequency of thenar/I_1 pattern, compared to the controls. Female epileptic patients showed higher frequency of I_1 patterns, compared to the normal controls.

2. I_2 pattern

The frequency of I_2 pattern in both male and female epileptic patients was not statistically significant.

3. I_3 pattern

In male epileptic patients both hands show lower frequency of I_3 pattern as compared to controls. In female epileptic patients right hand showed lower frequency of I_3 pattern as compared to controls, while left hand showed a higher frequency of I_3 pattern as compared to controls.

4. I_4 pattern

In male epileptic patients in right hand the frequency of I_4 pattern is lower compared to controls, while in left hand the frequency of I_4 pattern is higher as compared to controls, but the difference is statistically not significant.

Female epileptic patients showed higher frequency of I_4 pattern in both hands, which was statistically significant (Right Hand $x^2 = 4.133$; $p < 0.05$: Left hand $x^2 = 4.871$; $p < 0.05$).

5. Hypothenar pattern

In male epileptic patients the frequency of hypothenar pattern in both hands was higher as compared to controls. In female epileptic patient, the frequency of hypothenar pattern was lower as compared to controls.

Quantitative analysis

Mean Total Finger Ridge Count (TFRC)

In present study, the TFRC in male epileptics was 130 and in controls it was 125. The TFRC in female epileptics was 121 and in controls it was 107. Both male and female patients showed statistically significant higher mean TFRC.

A study reported mean TFRC as 142.9 male in epileptics whereas it was 131 in controls.[32]

Mean 'atd' angle

Mean atd angle in male and female patients was not showing any statistically significant difference in control and epileptic patients.

These differences in dermatoglyphic parameters being genetic markers raise the possibility of detecting those who are predisposed to develop the epilepsy. Thus further studies with a large population have to be conducted on dermatoglyphics in epilepsy, for the above mentioned parameters to be considered as "Dermatoglyphic markers of epilepsy".

CONCLUSION

The present work on dermatoglyphics in epilepsy has determined few significant parameters applicable to the epileptic patients.

Significant findings in qualitative analyses of epileptic patients include:

- Increase in frequency of radial loops in male epileptics on finger tips R_2 and L_2.
- Decrease in frequency of whorls on R_1, R_2, R_4 and L_4, and increased whorls on L_5 in male epileptics.
- Increase of I_4 patterns in both hands of female epileptics.

Significant findings in quantitative analysis of epileptic patients include:

- Increase of total finger ridge count (TFRC) in male and female epileptics.

No significant differences were observed in the following parameters of both hands:

- atd angle
- Thenar/I_1, I_2 and I_3 area patterns.
- Hypothenar pattern.

Thus with the help of these parameters, one can conclude that, there is some genetic basis for epilepsy and it is possible to a certain extent to predict from dermatoglyphic studies, individual's tendency for acquiring epilepsy.

But till today the studies in dermatoglyphics in epilepsy are very few in order to determine the use of dermatoglyphics as a diagnostic and screening

method. It is believed that many more workers will come out with research on this interesting aspect and sufficient data may accumulate to enable the clinician to predict the development of epilepsy, well in advance with the help of the dermatoglyphics.

SUMMARY

The present study was undertaken to investigate any relationship between palmar dermatoglyhics and epilepsy.

70 epilepsy patients (35 males, 35 females) from the Department of Neuromedicine, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum were taken for the study and their palmar dermatoglyphics were recorded and identical number of healthy males and females of the same age group were used as control. An official proforma for personal identification was also prepared.

Palm and finger prints were taken using ink method. Following dermatoglyphic parameters were considered for the study:

1. Finger print pattern
2. Hypothenar pattern.
3. Thenar pattern.
4. Total finger ridge count.
5. 'atd' angles.

The parameters were analyzed both qualitatively and quantitatively.

The results obtained were tabulated and graphically represented. They were analyzed statistically and tested for statistical significance.

Following significant findings may be considered as genetic markers for epilepsy:

- Increase in frequency of radial loops in male epileptic patients on finger tips of R_2 and L_2.
- Decrease in frequency of whorls on R_1, R_2, R_4 and L_4, and increased whorls on L_5 in male epileptic patients.
- Increase of TFRC in male and female epileptic patients.
- Increase of I_4 patterns in both hands of female epileptic patients.

With the help of these parameters a person who is at risk for developing epilepsy can be probably diagnosed before hand.

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ANNEXURE I – CONSENT FORM

STUDY OF PALMAR DERMATOGLYPHIC PATTERN IN EPILEPTIC PATIENTS OF KLES DR. PRABHAKAR KORE HOSPITAL AND MEDICAL RESEARCH CENTRE, BELGAUM

Principal Investigator

Dr. Santoshkumar Mulage
Department of Anatomy,
J. N. Medical College,
Belgaum

Purpose

To study the finger print patterns in epileptic individuals comparing with that of normal individuals.

Procedure

If I take part in the study I will be asked to ink the palm and fingers. Later prints are taken on a plain white paper.

Benefits

By this we can establish the importance of dermatolgyphics as an useful investigatory or screening procedure for epileptic patients. It may be beneficial to both clinicians and the patients in future.

Risks

Nil

Financial incentive for participation

Nil

Alternatives

Nil

Voluntary participation / withdrawal

Taking part in this study is voluntary. I may choose not to take part in the study, or it I decide to take part I can later change my mind and withdraw from the study. My decision will not change the present or future health care or other services that I receive. The study doctor or the sponsor may stop my participation in this study without my consent. While taking part in this study I will be told of any important new findings that may change my willingness to continue to take part. If I choose not to take part in the study will receive the standard treatment for patients with my condition.

Costs

Nil

Compensation

Nil as it is just observation and not an invasive procedure.

Confidentiality

All information collected about me during the course of the study will be kept confidential to the extent permitted by law. The code numbers will identify you in this study records and the information from this study may be published but your identity will be confidential in any publication.

Statement of consent

To voluntarily agree to take part in this study I must sign on the line below: If chose to take part in this study I may withdraw at any time I am not giving up any of my legal rights, by signing this form. My signature below indicates that I have read or have read to me this entire consent form including the risks and benefits and had all questions answered, I will be given a copy of this consent form.

Signature of the subject _____

Name _____ Date: _____

ANNEXURE II – PROFORMA

Name :

Age :

Sex :

Occupation :

Past history

History of major illness in the past:

Family history:

I. Qualitative traits

a. Finger print patterns

Right Hand	I	II	III	IV	V
Left Hand	I	II	III	IV	V

b. Interdigital patterns

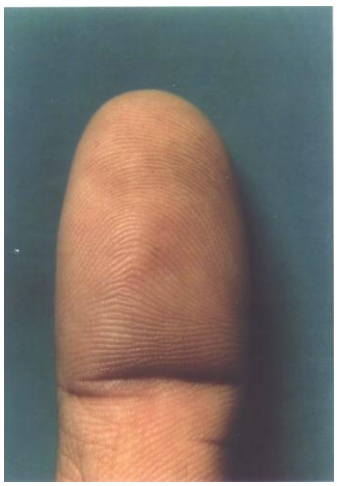
Right Hand	Th/I	I_1	I_2	I_3	I_4	Hy
Left Hand	Th/I	I_1	I_2	I_3	I_4	Hy

II. Qualitative traits

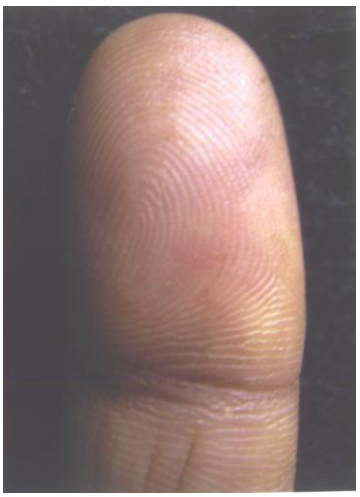
a. Total finger ridge count Right Hand Left Hand

b. ‘atd’ angle Right Hand Left Hand

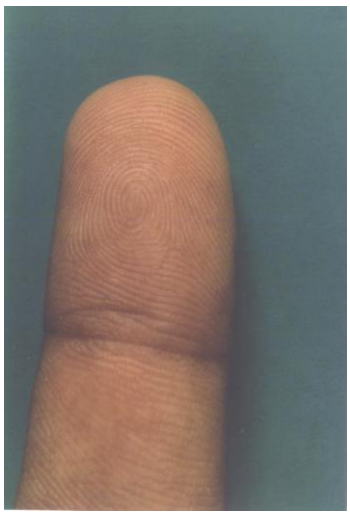
ANNEXURE III – PHOTOGRAPHS



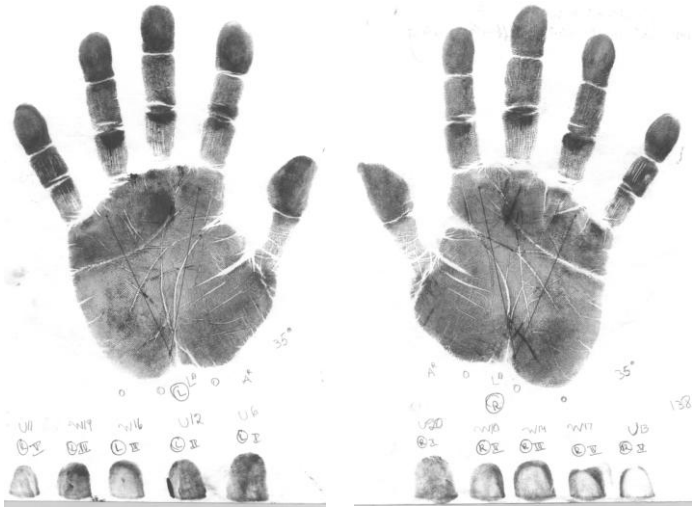
Photograph No. 1: Arch



Photograph No. 2: Loop



Photograph No. 3: Whorl



Photograph No. 4: Finger and palm prints

Photograph No. 5: Materials used

Photograph No. 6: Finger Print

Photograph No. 7: Palm Print

MASTER CHART - MALE CONTROLS

Sl. No.	Name	Age	Finger print pattern										TFRC	Palmar Pattern											
														I_1		I_2		I_3		I_4		Hyp		atd angle	
			R_5	R_4	R_3	R_2	R_1	L_1	L_2	L_3	L_4	L_5		Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt
1	PA	17	UL	W	UL	UL	W	UL	W	UL	W	UL	125	O	O	O	O	L	O	O	L	O	O	41	42
2	JVV	18	UL	UL	W	W	UL	W	W	W	UL	UL	120	L	O	O	O	O	L	O	O	O	O	33	34
3	AS	20	UL	W	UL	UL	W	UL	UL	UL	W	W	130	O	O	O	O	O	V	L	O	L	O	49	50
4	GST	22	W	W	W	A	A	UL	W	W	UL	UL	135	O	L	O	O	L	O	O	L	O	L	34	49
5	PD	23	UL	W	UL	UL	W	W	UL	UL	W	UL	115	O	V	O	V	O	L	L	O	O	V	48	35
6	DPV	17	W	UL	UL	A	W	UL	W	W	W	W	120	O	O	O	O	L	O	O	L	O	O	46	39
7	PSK	18	UL	W	UL	W	UL	W	UL	UL	W	UL	130	V	O	O	O	O	L	L	O	O	O	46	50
8	DVK	20	UL	UL	UL	UL	W	W	W	UL	W	W	140	O	O	O	O	L	O	O	L	L	O	36	34
9	DMK	16	UL	UL	UL	UL	UL	W	RL	W	UL	UL	110	O	O	O	O	O	L	O	O	O	O	44	40
10	JS	17	W	UL	W	W	W	UL	UL	UL	W	UL	122	O	O	V	O	L	O	L	L	O	O	38	44
11	BV	18	UL	W	UL	UL	W	W	W	W	W	UL	128	O	O	O	O	L	L	O	O	V	L	37	36
12	SPS	17	W	UL	W	W	UL	RL	UL	UL	W	UL	130	O	O	O	O	L	O	L	L	O	O	45	48
13	MAT	18	UL	W	UL	UL	UL	A	A	UL	UL	UL	120	V	O	O	O	O	L	L	O	O	O	37	50
14	TS	20	UL	W	W	W	W	UL	W	W	W	W	132	O	O	O	O	L	O	O	L	L	O	45	34
15	GSS	22	UL	UL	A	UL	UL	UL	UL	UL	W	UL	118	O	L	O	O	O	L	V	O	O	O	33	35
16	PRV	24	W	UL	UL	W	W	W	W	UL	W	UL	120	L	O	O	O	L	O	L	L	O	O	49	39
17	KSK	26	UL	W	UL	UL	UL	UL	UL	UL	W	UL	130	O	O	O	O	O	L	O	V	O	L	34	40
18	AK	27	W	W	UL	W	W	UL	W	UL	UL	UL	140	O	O	O	O	L	O	O	L	L	O	32	44
19	JMV	28	UL	W	UL	UL	UL	W	UL	UL	W	UL	110	O	O	V	O	O	O	L	O	O	O	48	46
20	KVT	30	UL	W	UL	A	W	UL	W	UL	UL	UL	120	O	O	O	O	O	L	O	L	O	O	38	38
21	DRT	35	W	W	UL	W	RL	UL	RL	A	W	A	140	O	O	O	V	L	O	L	O	O	O	34	46
22	RAE	40	UL	W	UL	UL	UL	W	UL	UL	W	UL	110	O	O	O	O	O	V	O	L	O	O	50	37
23	MST	40	W	A	A	W	W	UL	A	UL	A	UL	124	O	L	O	O	L	O	L	O	L	O	44	47
24	MRK	40	UL	W	UL	W	W	W	UL	UL	UL	UL	126	O	O	O	O	O	O	O	L	V	O	48	42
25	ETV	20	UL	W	UL	W	W	W	W	UL	W	UL	120	O	O	O	O	L	L	L	O	O	L	36	35
26	PC	22	W	W	UL	UL	W	UL	UL	W	UL	UL	130	O	O	O	O	L	O	O	L	O	O	43	44
27	KKT	24	UL	W	UL	W	UL	W	W	UL	W	W	135	L	O	O	O	O	O	L	O	L	V	39	40
28	AMV	30	UL	W	W	UL	UL	W	UL	UL	W	UL	115	O	O	O	O	L	L	L	L	O	O	40	41
29	JS	22	W	W	UL	W	UL	W	W	W	UL	W	130	O	O	O	O	O	O	O	O	O	O	42	43
30	LSY	24	UL	W	W	W	W	UL	UL	UL	W	UL	120	O	V	O	O	L	O	L	L	O	O	41	42
31	CHS	18	UL	W	UL	UL	UL	W	UL	UL	W	UL	130	O	O	O	O	O	V	L	O	V	O	41	42
32	KS	20	W	UL	UL	W	W	UL	W	W	UL	UL	120	O	O	O	O	L	O	O	O	O	O	40	44
33	PS	22	UL	W	W	UL	W	UL	UL	UL	W	UL	130	O	O	O	O	L	O	O	O	O	O	42	40
34	SM	20	W	UL	UL	W	W	W	W	UL	W	UL	127	O	O	O	O	O	O	O	O	O	V	45	45
35	YYV	18	UL	W	W	UL	UL	UL	UL	UL	W	UL	123	O	O	O	O	L	O	O	O	O	O	37	39

MASTER CHART - MALE EPILEPTICS

Sl. No.	Name	Age	Finger print pattern										TFRC	Palmar Pattern											
														I_1		I_2		I_3		I_4		Hyp		atd anlge	
			R_5	R_4	R_3	R_2	R_1	L_1	L_2	L_3	L_4	L_5		Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt
1	ABT	17	UL	W	UL	W	W	W	W	UL	W	UL	130	V	O	O	O	L	O	L	O	O	O	40	41
2	CTC	18	UL	UL	UL	RL	UL	UL	UL	UL	UL	W	134	O	O	V	O	O	O	O	L	O	L	38	43
3	VTB	20	UL	W	UL	W	W	W	W	UL	W	UL	126	O	O	O	O	L	L	L	O	L	O	42	39
4	ACT	22	UL	UL	W	UL	W	UL	RL	W	UL	A	140	O	V	O	O	O	O	O	L	O	O	37	40
5	MST	23	W	W	UL	RL	UL	W	W	UL	W	UL	120	O	O	O	V	O	O	O	O	O	O	43	42
6	CTV	17	UL	UL	A	W	UL	UL	UL	A	UL	W	125	O	O	O	O	L	V	L	L	L	O	41	45
7	UKK	18	UL	RL	UL	UL	W	UL	UL	UL	W	UL	135	O	O	O	O	L	O	O	O	O	O	39	37
8	RAG	20	UL	UL	UL	W	UL	W	W	UL	UL	UL	142	O	O	O	O	L	O	O	O	L	O	38	38
9	RVT	16	A	W	UL	RL	W	A	RL	UL	W	UL	118	O	O	O	O	O	O	L	L	O	O	42	44
10	LYZ	17	UL	UL	W	UL	W	W	W	UL	UL	W	138	O	O	O	O	L	L	O	O	O	L	37	45
11	PVV	18	W	W	UL	W	UL	UL	UL	UL	W	UL	122	O	O	L	O	O	O	L	L	O	O	43	37
12	BVD	17	UL	W	RL	UL	A	UL	UL	W	W	UL	121	O	L	O	O	L	O	O	O	L	O	45	43
13	CYZ	18	UL	UL	UL	W	UL	W	W	UL	UL	UL	139	O	O	O	O	O	O	O	L	O	O	35	39
14	CAG	20	W	W	UL	UL	UL	UL	UL	W	W	W	125	O	O	O	O	L	L	L	L	O	O	42	40
15	CAT	22	UL	UL	UL	W	W	W	W	UL	UL	UL	135	O	O	O	L	O	O	O	O	L	O	38	42
16	GGB	24	W	W	W	A	UL	UL	A	UL	W	UL	126	L	O	O	O	L	O	L	L	O	L	37	42
17	MNO	26	RL	W	UL	RL	UL	W	W	UL	RL	UL	134	V	O	O	O	O	O	O	L	O	O	43	40
18	CBD	27	W	UL	W	W	W	UL	UL	UL	W	W	125	O	O	O	V	L	L	O	O	L	O	41	39
19	DCC	28	UL	W	UL	UL	UL	UL	W	UL	UL	UL	135	O	O	O	O	O	O	O	L	O	O	39	43
20	CGV	30	W	UL	UL	W	W	W	UL	W	W	UL	120	O	O	O	O	L	O	O	O	O	O	42	40
21	UVZ	35	UL	W	UL	UL	UL	UL	W	UL	UL	UL	140	O	O	O	O	O	L	L	L	O	O	38	42
22	PZV	40	UL	UL	W	W	UL	W	A	W	W	UL	132	O	O	O	O	L	O	O	O	O	L	39	43
23	VVL	40	W	W	UL	UL	UL	W	UL	UL	UL	W	128	O	O	O	O	O	O	O	O	O	O	41	39
24	RDD	40	UL	UL	UL	W	UL	UL	UL	UL	W	UL	134	O	O	O	O	L	L	O	L	V	O	44	42
25	YZT	20	UL	W	UL	UL	UL	W	A	UL	W	UL	126	O	O	O	O	L	O	O	L	O	O	36	40
26	CTV	22	W	W	UL	UL	UL	W	UL	UL	W	UL	135	O	O	O	O	O	O	O	L	O	O	40	41
27	XLP	24	UL	W	UL	W	W	UL	W	A	UL	UL	125	O	O	O	O	O	L	L	O	O	O	42	42
28	ABD	30	UL	UL	W	RL	UL	UL	UL	UL	A	W	140	O	O	O	O	L	O	L	L	O	O	38	40
29	CBD	22	UL	W	UL	A	W	W	W	W	UL	UL	120	O	O	O	O	O	O	O	O	L	O	36	44
30	YAZ	24	W	UL	W	W	UL	UL	RL	UL	W	UL	132	O	O	O	O	V	O	V	L	O	V	44	38
31	MNO	18	UL	W	UL	UL	W	W	W	UL	UL	UL	128	O	O	O	O	O	O	L	O	O	O	45	40
32	ACB	20	W	W	W	A	UL	UL	UL	UL	W	W	126	O	O	V	O	L	O	O	L	L	O	35	42
33	YAZ	22	UL	W	UL	RL	W	UL	RL	W	UL	UL	134	O	V	O	V	O	O	O	O	O	O	41	39
34	ZSS	20	UL	A	UL	UL	UL	A	W	W	W	UL	140	O	O	O	O	O	O	L	L	V	O	39	43
35	PSK	18	UL	W	UL	UL	W	UL	UL	UL	UL	UL	120	O	O	O	O	L	L	O	V	O	L	39	45

MASTER CHART - FEMALE CONTROLS

Sl. No.	Name	Age	Finger print pattern										TFRC	Palmar Pattern											
														I_1		I_2		I_3		I_4		Hyp		atd anlge	
			R_5	R_4	R_3	R_2	R_1	L_1	L_2	L_3	L_4	L_5		Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt
1	YVW	18	UL	W	UL	UL	W	UL	UL	UL	UL	UL	107	O	O	O	O	O	O	O	L	O	O	38	40
2	RKA	16	W	W	UL	W	UL	W	W	W	W	UL	117	O	O	O	O	L	L	L	O	O	O	42	42
3	PS	18	UL	UL	UL	UL	W	UL	UL	UL	RL	UL	97	O	O	O	O	O	O	O	L	L	O	39	40
4	JPS	18	UL	UL	UL	W	UL	W	A	UL	W	W	110	O	O	O	O	L	O	O	L	O	L	41	42
5	KAB	20	UL	W	W	A	W	UL	UL	UL	UL	UL	104	V	O	O	O	L	O	O	L	O	O	38	40
6	UUB	22	W	UL	UL	W	UL	W	W	W	W	UL	120	O	O	O	O	O	L	L	O	O	L	42	42
7	PAK	24	UL	W	UL	UL	W	UL	UL	UL	UL	UL	94	O	V	O	O	L	L	O	L	O	O	41	42
8	KKA	25	UL	UL	UL	W	UL	W	UL	UL	W	W	108	O	O	O	O	O	O	L	O	O	O	39	40
9	KKP	30	UL	W	UL	UL	UL	UL	W	UL	UL	UL	106	L	O	L	O	O	L	O	L	O	O	37	38
10	RKS	35	UL	UL	UL	W	UL	W	UL	RL	W	UL	110	O	O	O	O	O	O	L	V	L	O	43	44
11	VD	20	UL	W	W	UL	W	UL	A	UL	UL	UL	104	O	L	O	O	V	O	O	L	O	O	36	40
12	PB	22	UL	UL	UL	W	UL	W	UL	UL	W	W	111	O	O	O	O	O	L	L	O	O	O	44	42
13	MS	24	UL	W	UL	UL	W	UL	W	UL	UL	UL	103	O	O	O	O	L	O	V	O	L	O	38	40
14	SHP	22	UL	UL	UL	A	UL	W	UL	A	W	UL	115	O	O	O	O	O	O	L	O	O	O	42	42
15	HSP	28	UL	W	UL	UL	UL	UL	A	UL	UL	UL	99	O	O	O	O	L	L	O	L	O	O	44	44
16	KKP	30	UL	UL	UL	W	UL	W	UL	W	A	W	110	O	O	O	O	O	O	L	O	O	O	36	38
17	VVW	32	UL	W	W	UL	W	UL	W	UL	UL	A	104	O	O	O	O	L	O	O	L	L	O	41	42
18	VVL	22	UL	UL	UL	W	UL	W	A	UL	W	UL	111	V	O	O	O	O	V	L	O	V	O	39	40
19	RDA	20	UL	W	UL	UL	W	UL	UL	UL	UL	UL	103	O	O	O	O	L	L	O	L	O	O	42	42
20	JJV	22	UL	UL	A	A	UL	W	W	W	W	UL	112	O	V	L	O	O	O	L	O	O	O	38	40
21	KKL	24	UL	W	UL	UL	W	UL	UL	UL	UL	W	102	O	O	O	O	V	L	O	L	L	O	36	38
22	PPT	24	UL	W	UL	W	UL	W	W	A	W	UL	112	O	O	O	O	L	O	L	O	O	O	44	44
23	CCT	18	W	UL	W	UL	W	UL	W	UL	UL	UL	102	O	O	O	O	O	O	O	O	O	O	36	39
24	PBG	20	UL	W	UL	RL	UL	W	UL	UL	W	UL	110	O	O	O	O	L	L	L	O	L	L	36	43
25	JK	21	UL	UL	UL	UL	W	UL	A	UL	UL	UL	104	O	O	O	O	O	O	O	O	O	O	44	42
26	SSS	24	UL	W	W	W	UL	W	UL	W	W	W	112	O	O	O	O	L	O	O	O	O	O	40	40
27	YYG	20	UL	UL	UL	UL	W	UL	W	UL	UL	UL	102	O	O	L	O	L	O	O	L	O	O	42	40
28	GAD	22	UL	W	UL	W	UL	A	UL	W	W	UL	108	O	O	O	O	O	L	O	O	L	O	38	42
29	CCD	20	UL	UL	UL	UL	A	UL	W	UL	UL	UL	106	O	O	O	O	L	O	O	O	O	L	37	40
30	ACB	22	UL	W	UL	UL	UL	UL	UL	UL	W	UL	110	O	O	O	O	L	O	O	O	O	O	43	42
31	CCW	22	UL	UL	UL	UL	UL	UL	W	UL	W	UL	104	O	O	O	O	L	O	O	O	L	O	38	40
32	LLK	24	UL	W	W	W	W	UL	A	W	UL	W	114	O	O	O	O	O	O	O	O	O	L	42	42
33	WK	20	UL	A	UL	UL	UL	UL	W	UL	W	UL	100	V	O	O	O	L	L	O	O	O	O	37	39
34	WY	22	A	W	UL	RL	W	A	RL	W	UL	UL	102	O	O	V	O	O	O	O	O	L	O	43	43
35	RAG	21	UL	W	UL	UL	UL	UL	UL	UL	W	UL	112	O	O	O	O	L	O	V	O	O	V	36	38

MASTER CHART - FEMALE EPILEPTICS

Sl. No.	Name	Age	Finger print pattern										TFRC	Palmar Pattern											
			R_5	R_4	R_3	R_2	R_1	L_1	L_2	L_3	L_4	L_5		I_1		I_2		I_3		I_4		Hyp		atd anlge	
														Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt
1	JBT	20	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	122	O	O	O	O	O	O	O	Lt	O	O	39	41
2	AB	18	UL	W	W	W	W	W	UL	W	W	UL	130	O	O	O	O	O	L	L	L	O	O	40	42
3	SBT	16	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	122	O	O	O	O	O	O	O	L	L	O	41	41
4	RT	17	UL	W	UL	W	W	W	W	A	W	W	126	O	O	O	O	L	O	L	O	O	O	37	40
5	ZM	18	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	114	V	O	O	O	O	O	O	L	O	O	38	40
6	SS	20	W	W	W	W	W	W	A	W	W	UL	126	O	O	O	O	O	O	L	O	O	Lt	40	42
7	AK	22	UL	W	UL	UL	UL	UL	W	UL	UL	UL	118	O	V	O	O	L	L	O	L	O	O	38	40
8	ZB	18	UL	UL	UL	W	W	W	UL	A	W	W	118	O	O	O	O	O	O	L	O	O	O	39	42
9	MM	30	UL	W	UL	UL	UL	UL	W	UL	UL	UL	124	L	O	O	O	L	O	O	L	O	O	37	39
10	IS	32	W	UL	W	W	W	W	UL	W	W	UL	132	O	L	O	O	O	O	L	V	L	O	41	43
11	PHK	30	UL	W	UL	UL	UL	UL	W	UL	UL	UL	112	O	O	O	O	V	O	O	L	O	O	40	40
12	RHK	20	UL	UL	RL	W	UL	W	UL	W	W	W	130	O	O	O	O	L	L	L	O	O	O	38	41
13	KVD	22	UL	W	UL	UL	UL	UL	A	UL	UL	UL	114	O	O	O	O	O	O	V	L	O	L	39	40
14	KDT	24	UL	UL	UL	W	A	W	UL	UL	W	UL	120	O	O	O	O	L	O	L	O	O	O	40	42
15	KDT	26	UL	W	UL	UL	UL	UL	W	UL	UL	UL	124	O	V	L	O	L	L	O	L	O	O	38	41
16	SJ	28	UL	UL	W	RL	W	W	A	W	W	UL	126	O	O	O	O	O	O	L	O	O	O	39	40
17	SSK	30	UL	W	UL	UL	UL	UL	UL	UL	UL	UL	118	O	O	O	O	L	O	O	L	L	O	37	40
18	SVS	31	UL	W	UL	A	UL	UL	W	UL	W	W	120	V	O	O	O	O	V	L	O	V	O	41	42
19	UKT	33	W	W	UL	UL	UL	UL	W	UL	UL	UL	124	O	O	O	O	L	L	O	L	O	O	40	42
20	KAC	30	UL	RL	A	W	W	W	W	W	W	UL	130	O	O	O	O	O	O	L	O	O	O	38	41
21	SYK	17	UL	W	UL	UL	UL	UL	UL	UL	UL	UL	114	O	O	O	O	V	O	O	L	O	O	40	42
22	PS	16	UL	UL	UL	W	UL	W	W	W	W	W	121	O	O	O	O	L	O	L	O	O	L	38	40
23	GP	22	UL	W	UL	UL	UL	UL	UL	UL	UL	UL	123	O	O	O	O	O	O	O	L	O	O	37	40
24	AD	20	UL	UL	W	W	UL	W	UL	A	W	UL	125	O	O	O	O	L	L	L	O	L	O	37	41
25	SJT	22	W	W	UL	UL	UL	UL	UL	UL	W	UL	119	O	O	O	O	O	O	O	O	L	O	41	42
26	MS	24	UL	UL	UL	W	W	W	W	W	UL	UL	120	O	O	O	O	L	L	L	O	O	O	41	42
27	DD	26	UL	W	UL	UL	UL	UL	UL	UL	W	UL	124	L	L	O	O	O	O	O	L	O	L	37	40
28	VB	21	UL	UL	UL	W	W	W	W	W	W	UL	125	O	O	O	O	L	L	L	O	O	O	41	42
29	SKT	22	UL	W	UL	UL	UL	UL	W	UL	UL	UL	119	O	O	O	O	O	O	O	L	O	O	39	42
30	VKT	24	UL	W	UL	A	W	W	W	A	W	UL	122	O	V	O	O	L	L	L	O	O	O	39	41
31	SRT	17	UL	W	UL	UL	UL	UL	UL	UL	W	UL	125	O	O	O	O	L	L	L	L	O	O	40	41
32	VM	18	UL	UL	W	RL	W	RL	RL	W	UL	A	119	O	O	O	O	O	O	L	O	O	V	38	40
33	CCT	20	UL	UL	UL	UL	UL	UL	A	UL	W	UL	120	O	L	O	O	L	L	O	L	L	O	32	40
34	CCK	22	UL	UL	A	W	UL	A	RL	UL	A	UL	122	O	O	O	O	O	O	L	O	O	O	41	42
35	CKV	24	UL	W	UL	UL	W	W	UL	UL	W	W	121	O	O	O	O	L	L	O	O	O	V	38	40