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Original Article

Comparative Study of Toe Patterns in the Acquired Idiopathic Blindness in Some Selected Schools for the Blind in Nigeria

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ABSTRACT

Objectives: This study was done to investigate whether there is a characteristic toe pattern in acquired idiopathic blindness. To investigate whether there is significant difference between the two categories. **Experimental Approach**: A Non-experimental analytical and cross-sectional study .The study involved 72 subjects with 36 blind (22 males & 14 females) and 36 non-blind (18 males and 18 females) subjects. Hp g3110 photo scanner print capture model was used. The various toe patterns of arches, loops and whorls were counted using a laptop zooming tool for a clearer view and classified using the standard method (loesch and skrinjaric method). Data analysis was done using z-test of proportionality. **Findings and Discussion**: The total toe patterns of the subjects on the right foot was arch 7(19.4%), distal loop 15(41.7%), fibular loop 5(13.9%), tibial loop 4(11.1%), whorl 5(13.9%) and on the left foot it was arch 7(19.4%), distal loop 14(38.9%), fibular loop 5(13.9%), tibial loop 4(11.1%) and whorl 6(16.7%) while for the non-blind subjects the distribution was as follows on the right foot: arch 4(11.1%), distal loop 21(58.3%), fibular loop 4(11.1%), tibial loop 2(5.6%), whorl 5(13.9%) whereas on the left foot it was the following arch 4(11.1%), distal loop 20(55.5%), fibular loop 4(11.1%), tibial loop 2(5.6%) and whorl 6(16.7%). **Conclusion**: A characteristic toe pattern for acquired idiopathic blindness and in non-blindness that could be used to predict idiopathic blindness in the process of time was established since there was statistical significance (p=0.001) present in the distal loop on the left foot.

Keywords: Comparative, Idiopathic blindness, Nigeria, Toe patterns.

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1. INTRODUCTION

Dermatoglyphics is considered as the branch of science which studies the patterns of the skin (dermal) ridges present

on human fingers, toes and the soles. There have been literatures reiterating the various usefulness of dermatoglyphics in diagnosis or prediction of the following: Diabetes mellitus type 2 [1], Mental retardation [2], E-beta thalassemia [3], Cystic Fibrosis [4], Dental arch forms [5], Cancer [6], Polydactly[7], Autism [8], Bruxism [9], Malocclusion [10], Interpopulation affinities [11]. Some works have also been done on toe patterns [12, 13, 14] by other authors though not on blindness. Previous works have mentioned that friction ridge skin has unique features that persist from before birth till death[16]. When these ridges make contact with a surface, the unique features of friction ridge skin may leave an impression of corresponding unique details [16]. Two impressions can be analyzed, compared, and evaluated, and if sufficient quality and quantity of detail is present (or lacking) in a corresponding area of both impressions, a competent examiner can effect an individualization or exclusion (identify or exclude an individual) [16].The analysis, comparison, evaluation, and verification (ACE-V) methodology, combined with the philosophy of quantitative–qualitative examinations, provide the framework for practical application of the friction ridge examination discipline [16]. But at the heart of the discipline is the fundamental principle that allows for conclusive determinations: the source of the impression, friction ridge skin, is unique and persistent [16]. A lot has been done on dermatoglyphics that even ancestry is being traced using dermatoglyphic patterns.

Statement of the Problem: Blindness in our environment has been speculated to have dermatoglyphic patterns but this has not been verified or proven yet.

Aim: The study was aimed at investigating whether there is a characteristic toe pattern in acquired idiopathic blindness and comparing with non-blind subjects.

Scope of the Study: This study was primarily concerned with the plantar and toe prints of the subjects.

Justification: The population of the blind in Nigeria was 1,100,000 as at 2012 considering the growth rate (Gr.) per year which is estimated to be 2.5/10 or (¼) of the previous figure. It therefore means that if no drastic action is taken to curb the prevalence of blindness by 2020 the figure would be outrageous for this reason, the WHO & International Agency for the prevention of blindness (IAPB) have brought global Initiative for the elimination of avoidable blindness. If blindness has dermatoglyphic presentation as have been speculated, then it can be predictive as such proactive measures could be taken to reduce the prevalence by 2020.

2. MATERIAL AND METHODS

Research Design: A Non-experimental analytical and cross-sectional study used to compare plantar dermatoglyphics in acquired idiopathic blindness and in non-blindness in Southern Nigerian population. Using print capture model as used [15].

A total of 72 subjects comprising 14 female blind, 22 male blind, 18 female non-blind and 18 male non-blind subjects were employed in the study. Every subject selected was totally blind on both eyes with no form of anatomical abnormality of the feet and toe whose cause of blindness is unknown. Individuals with foreign nationality, with distorted toe prints that were not visible enough to be classified into arches, loops or whorls were excluded.

Convenience purposive sampling technique was used and ethical clearance was sort from the ethics committee of the University of Port Harcourt.

Data Collection: The bilateral toe prints were obtained using print scanner (HP G3110 photo Scanner) and transferred to a mini- laptop using USB cords. The various toe patterns of arches, loops and whorls were counted with the aid of a laptop zooming tool for a clearer view and classified using the standard method (Loesch and Skrinjaric method) where the prints are sort and arranged in the class of arches, loops, whorls and summed up to give the final figure for each pattern present [17]. The feet was thoroughly washed with water and detergent and dried before taking prints. Both feet were gently and carefully placed on the scanner for adequate contact between the toes and the scanner this was done to have a sharp toe print capture. The process was done twice and repeated for the blind and non-blind subjects.

Data analysis: This was done using (IBM) SPSS Statistics version 22. Z-test of proportionality difference was used to determine the difference in the proportion of patterns among the populations. The z-score test for two population proportions is used when you want to know whether two populations or groups (e.g., males and females; theists and atheists) differ significantly on some single (categorical) characteristic. Conditions for using z test of proportionality: A random sample of each of the population groups to be compared and must be a categorical data [18].

3. RESULTS AND DISCUSSION

Results:

In table 1 the male toe patterns of the subjects were observed. The blind and non-blind subjects had equal frequency distribution of the fibular loop {3(13.6%) and 3(16.7%)} respectively on the right foot.

In table 2 the female toe patterns of the subjects were observed. The tibial loop had equal frequency distribution for the blind and non-blind subjects {1(7.1%) and 1(5.6%)} respectively on the right foot. Similarly, the fibular loop had equal frequency distribution for the blind and non-blind subjects {3(21.5%) and 3(16.7%)} respectively on the left foot.

In table 3 the total toe patterns of the subjects were observed. The whorl had equal frequency and percentage distribution for the blind and non-blind subjects {5(13.9%) and 5(13.9%)} respectively on the right foot and on the left foot as well with {6(16.7%) and 6(16.7%)}.

In table 4 there was no statistical significance in the male and female toe patterns on comparison using z-test of proportionality.

In table 5 there was no statistical significance in the total toe patterns except in the distal loop of the left foot on comparison using z-test of proportionality.

Discussions:

Patterns for the blind, (arch, fibular loop and tibial loop) were equal on both feet; the distal loop was more on the right foot than the left foot while whorl was lesser on the right foot than the left foot. For the non-blind subjects, (arch and whorl) were lesser on the right foot than the left foot; the distal and fibular loops were more on the right foot than the left foot whereas the tibial loop was equal on both feet. On the right feet, (arch and distal loop) were higher in the blind subjects, the fibular loop was equal on both blind and non-blind, tibial loop and whorl were lesser in the blind than non-blind. On the left feet, (arch, distal loop and fibular loop) were higher in the blind and non-blind subjects while the tibial loop and whorl were lesser in the blind than the non-blind on the left feet. The comparison of the male toe patterns of the blind and non-blind was shown on Z- test of proportionality to have no statistical significant difference in all digital patterns for the right and left hand at P=.05 except for the left tibial loop where it was statistically significant at P=.05.

Patterns for the blind, (arch, tibial loop and whorl) were equally distributed on both feet; the distal loop was higher on the right foot than the left foot while the fibular loop was lesser on the right foot than the left foot. For the non-blinds, (arch, fibular loop and whorl) had equal distribution on both feet; the distal loop was higher on the right foot while the tibial loop was lesser on the right foot. On the right foot, the non-blind blind subjects had higher distribution of the patterns except for the tibial loop on the right foot and fibular loop on the left foot where there was equal distribution of patterns. The comparison of the female toe patterns of the blind and non-blind was shown on Z- test of proportionality to have no statistical significant difference in all toe patterns for the right and left foot at P=0.05.

The arch was most distributed on the fifth toe, loop on the third toe and whorl on the big toe which indicates a characteristic toe pattern in acquired blindness while in non-blindness the characteristic pattern was arch on the third toe, loop on the big toe and whorl on the fourth toe. In the distribution of the patterns for the blind subjects: the arch, fibular loop and tibial loop had equal distribution of patterns on both feet, the distal loop was higher on the right foot and the whorl was lesser on the right foot. For the non-blinds, (arch, fibular loop and tibial loop) had equal distribution on both feet. The distal loop had a higher distribution on the right foot than the left foot while the whorl had lesser distribution on the right foot. On both feet, (arch, fibular loop and tibial loop) had higher distribution in the blind while the distal loop was lesser in distribution in the blind; the whorl had equal distribution in the blind and non-blind. The comparison of the male toe patterns of the blind and non-blind was shown on Z- test of proportionality to have statistical significant difference (P=0.001) in the distal loop on the left feet which suggests that the characteristic pattern seen in idiopathic blindness did not happen by chance but an anatomical landmark.

Table 1: Male Toe Patterns of the Right and Left Foot

MALE TOE PATTERNS (%)					
RIGHT FOOT	Arch	Distal Loop	Fibular Loop	Tibial Loop	Whorl
Blind	5(22.7)	10(45.5)	3(13.6)	2(9.1)	2(9.1)
Non-Blind	3(16.7)	6(33.2)	3(16.7)	3(16.7)	3(16.7)
LEFT FOOT					
Blind	5(22.7)	9(41.0)	3(13.6)	2(9.1)	3(13.6)
Non-Blind	4(22.2)	5(27.8)	2(11.1)	3(16.7)	4(22.2)

Key: The figures in parenthesis are in percentages. *P*=.05

There was no statistical significance in the male toe patterns on comparison using z-test of proportionality**.**

Table 2: Female Toe Patterns of the Right and Left Foot

FEMALE TOE PATTERNS (%)					
RIGHT FOOT	Arch	Distal Loop	Fibular Loop	Tibial Loop	Whorl
Blind	2(14.3)	5(35.7)	2(14.3)	1(7.1)	4(28.6)
Non-Blind	3(16.7)	6(33.3)	3(16.7)	1(5.6)	5(27.7)
LEFT FOOT					
Blind	2(14.3)	4(28.5)	3(21.5)	1(7.1)	4(28.6)
Non-Blind	3(16.7)	5(27.8)	3(16.7)	2(11.1)	5(27.7)

Key: The figures in parenthesis are in percentages. *P*=.05

Table 3: Total Toe Patterns of the Right and Left Foot

TOTAL TOE PATTERNS (%)					
RIGHT FOOT	Arch	Distal Loop	Fibular Loop	Tibial Loop	Whorl
Blind	7(19.4)	15(41.7)	5(13.9)	4(11.1)	5(13.9)
Non-Blind	4(11.1)	21(58.3)	4(11.1)	2(5.6)	5(13.9)
LEFT FOOT					
Blind	7(19.4)	14(38.9)	5(13.9)	4(11.1)	6(16.7)
Non-Blind	4(11.1)	20(55.5)	4(11.1)	2(5.6)	6(16.7)

Key: The figures in parenthesis are in percentages. P=.05

Table 4: Z-test Comparing Male & Female Toe Patterns in the Blind and Non-Blind

Comparing Male & Female Toe Patterns in the Blind and Non-Blind Toe Patterns (%)										
	Right Foot					Left Foot				
	Arch	Distal Loop	Fibular Loop	Tibial Loop	Whorl	Arch	Distal Loop	Fibular Loop	Tibial Loop	Whorl
Blind Male	5	10	3	2	2	5	9	3	2	3
Blind Female	2	5	2	1	4	2	4	3	1	4
Z-Test Analysis										
Z score	0.623	0.577	-0.054	0.206	-1.528	0.623	0.751	0.000	0.206	-1.103
p-value	0.535	0.561	0.960	0.833	0.126	0.535	0.453	1.000	0.833	0.271
Inference	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
Non-Blind M	3	6	3	3	3	5	9	3	2	3
Non-Blind F	3	6	3	1	5	3	5	3	2	5
Z-Test Analysis										
Z score	0.000	0.000	0.000	1.060	-0.801	0.421	0.000	-0.481	0.481	-0.384
p-value	1.000	1.000	1.000	0.289	0.423	0.674	1.000	0.631	0.631	0.703
Inference	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Key: N.S- Not Significant, S-Significant

Table 5: Z-test Comparing Total Toe Patterns in the Blind and Non-Blind

Comparing Total Toe Patterns in the Blind and Non-Blind Toe Patterns (%)										
	Right Foot					Left Foot				
	Arch	Distal Loop	Fibular Loop	Tibial Loop	Whorl	Arch	Distal Loop	Fibular Loop	Tibial Loop	Whorl
Blind	7	15	5	4	5	7	14	5	4	6
Non-Blind	4	21	4	2	5	4	20	4	2	6
Z-Test Analysis										
Z score	0.982	-1.414	0.356	0.852	0.000	0.982	-5.180	0.356	0.852	0
p-value	0.327	0.158	0.718	0.395	1	0.327	0.001	0.718	0.395	1
Inference	N.S	N.S	N.S	N.S	N.S	N.S	S	N.S	N.S	N.S

Key: N.S- Not Significant, S-Significant

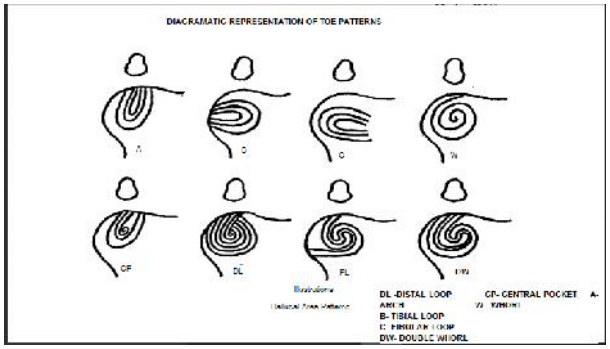

Fig1: Illustrating the different toe patterns [19]

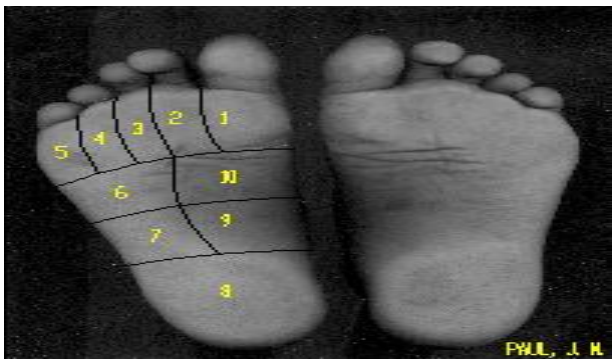

Fig 2: Showing the plantar surface of the foot and toes

4. CONCLUSION

There was established a characteristic toe pattern for in acquired idiopathic blindness and in non-blind subjects that could serve as indications of idiopathic blindness in the near future. There was statistical significant difference (P=0.001) in the toe pattern in distal loop on the left feet suggests that the characteristic pattern seen in idiopathic blindness did not happen by chance but an anatomical landmark. If idiopathic blindness has a characteristic pattern it therefore means that predictive and proactive measures can be taken to curb the growing prevalence of blindness especially in Sub-Sahara Africa.

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