

*Original Research***Dermatoglyphics and Dental Caries: A Correlation Study among School Children of Kanpur City, India.**

Saxena A, Pradhan D, Pruthi N

**Abstract: background:** Dermatoglyphics a known diagnostic tool in the field of genetic, medical and dentistry is the study of the configuration of epidermal ridges on fingers, palms and soles. The epithelium of finger buds and enamel both are ectodermal in origin. Hence, dermatoglyphics can be used in predicting dental caries. **Aim:** The aim of the present study was to find out an association between the different patterns of fingerprints and Dental caries amongst school children of 12-15 years of age. **Materials and Method:** The study was conducted on 276 school children in age group of 12 to 15 years from 6 private schools of Kanpur city. The finger prints of both hands were taken using the blue ink and pattern were analysed, for recording dentition status, DMFT index was recorded. SPSS version 17.0 was used to analyze the data. **Results:** There was increase in frequency of whorls and decrease in frequency of loops in caries active children when compared to caries free children. On the other hand caries free group showed significant decrease in frequency of whorls and increase in frequency of loops pattern ( $p < 0.05$ ). **Conclusion:** Dental caries susceptibility of an individual increased with incidence of whorl pattern and it decreased with incidence of loop pattern.

Key words: Dermatoglyphics; Finger print; Dental caries; School children.

**INTRODUCTION**

'Dermatoglyphics' is the word derived from Greek words 'Derma' i.e. skin and 'Glyphics' which means carvings.<sup>1</sup> The ridge formation over the skin surface of fingers begins to appear during 3<sup>rd</sup> and 4<sup>th</sup> month of foetal development and remain the same throughout the life.<sup>2</sup> These dermal ridges are determined genetically and modified by the environmental factors. Dermatoglyphics is the study in which we study the ridge patterns present over the skin surfaces of hands and feet. Harold Cummins is known as the "Father of Dermatoglyphics"<sup>3</sup> and this term was introduced by him and Midlo in 1926.

In India, people believe in Palmistry but hardly anyone believes that the pattern of fingerprints can determine oral health conditions as well. Dermatoglyphics has many medical, dental and genetic implications which can predict many disorders and these ridge patterns have recently been positively associated to predict genetic diseases<sup>4</sup>, cleft lip and palate<sup>5</sup>, Malocclusion<sup>6,7</sup>, dental caries<sup>2,8,9,10,11,12</sup>, periodontal diseases<sup>13</sup> and Oral cancer<sup>14</sup> etc.

Fingerprints are unique patterns, which can never be common in two people, for the same individual also the finger print can't be

same for two fingers, even the identical twins don't share similar patterns with each other.<sup>15</sup> Sir Francis Galton started his research in the year 1880 with Charles Darwin on Fingerprints and published his book on 'Fingerprints' in the year 1892.<sup>16</sup> The classification on fingerprints can first be found in this book and it is grouped as Loop, Whorl and Arches.

Dental caries is an irreversible, progressive and multifactorial disease which has genetic susceptibility as one of the factor. The epithelium of finger buds and enamel both has the ectodermal origin.<sup>17,18</sup> Hence, the dental tissue whether normal or abnormal can be explained by dermatoglyphics. Thus, with genetic information, the susceptibility for caries due to abnormality in the tooth structures like alterations in dental hard tissues like structure of dental enamel, tooth eruption and development may be reflected in the dermatoglyphics namely whorl and loop patterns.<sup>2,13,19</sup>

**Different Patterns of Ridge Arrangement<sup>16</sup> are:**

1. **Loop:** It is the most common type of pattern exists in 60% of the global population. Loops contain more ridges and always contain one delta which is triangular in shape. A delta is the point marked at the

junctions of three ridges that form approximately an angle of  $120^\circ$  with one another. Loops enter from one side reoccur and exit from the same side only. There are two types of loop exist: Ulnar loops flow towards the little finger (Fig 1A), 2) Radial loops flow towards the thumb (Fig 1B).

2. **Whorl:** They exist in approximately 35% of the global population (Fig 1C). They contain fewer ridges as compare to loops. They have concentric arrangements of ridges and contain 2 or more deltas. They are of four types: a) Plain b) Central Pocket c) Double d) Accidental.

3. **Aches:** Total 5% of the global population contain Arch form of pattern. They are the simplest form of ridge pattern and are formed by series of ridges which enter from one side and without recurving exist from the other side. Any patterns of Arches don't contain delta or core, and these are: a) Plain arches (Fig 1D), b) Tented (Fig 1E).

The aim of the present study was to find out an association between the different patterns of fingerprints and Dental caries amongst school children of 12-15 years of age. Other objectives of the study were to evaluate the prevalence of dental caries among students and also to identify the prevalence of type of finger print associated with caries free and carious students.

#### MATERIALS AND METHODS

A cross sectional study was performed on 276 school children of six randomly selected schools of different zones of Kanpur city, age group 12-15 years. Ethical Clearance was obtained from the Institutional Review Board of Rama Dental College, Hospital and Research centre of Kanpur city. Training and Calibration of two examiners who were conducting the study was done at the institution under the supervision of the teaching staff.

Study was explained to the Principles of respective Schools and Written Permission was obtained to conduct the study. Participants included in the study comprised of the students who were present on the day of data collection. Uncooperative patients and patients with special health care needs (physically and mentally challenged and participants with

cleft lip and palates), patients who had trauma to fingertips and mehendi were excluded from the study.

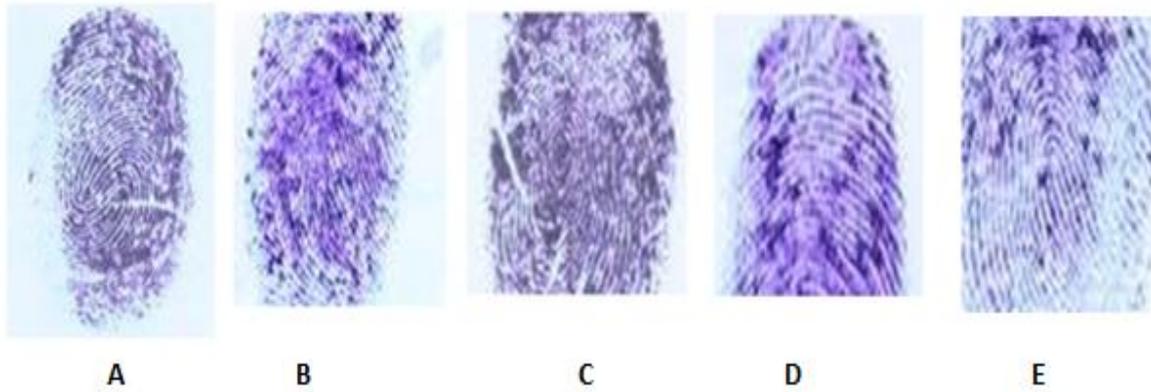
DMFT index was recorded to assess dentition status of the participants. Instruments included for recording dentition status and finger prints were: Mouth mirror, Explorer, Gauze pieces and cotton, Blue Printing ink, Glazed plain white paper, Magnifying glass, Torch. On the day of examination, participants' dental status was examined and recorded in a well illuminated area. An additional glazed paper was attached to the DMFT recording format for recording fingerprint pattern. Hands of the subjects were cleaned before recording finger impressions with soap and water and were blot dried. One by one each student was called for recording fingerprints in presence of the examiner. Ink was applied on subject's fingertips and they were pressed on white sheet.

Each impression was analyzed using magnifying glass and if the fingerprint was proper it was finalized or if not then it was recorded again. After recording, the fingertips were cleaned with cotton so that the students don't spoil their clothes. Children Dentition status was analysed using DMFT index given by Henry Klein, Carrole E. Palmer, and Knutson JW (1938).<sup>20</sup> To eliminate any bias, oral health examination and fingerprint recording was done by two examiners separately.

Starting from left hand's little finger till right hands little finger the patterns were analyzed for Loops, Whorls, Arches (Fig 1A-E) and Total ridge count. Total ridge count was counted by joining core to delta and all the ridges that are present between this line or that cross this line were counted as total ridge count (Fig 2).



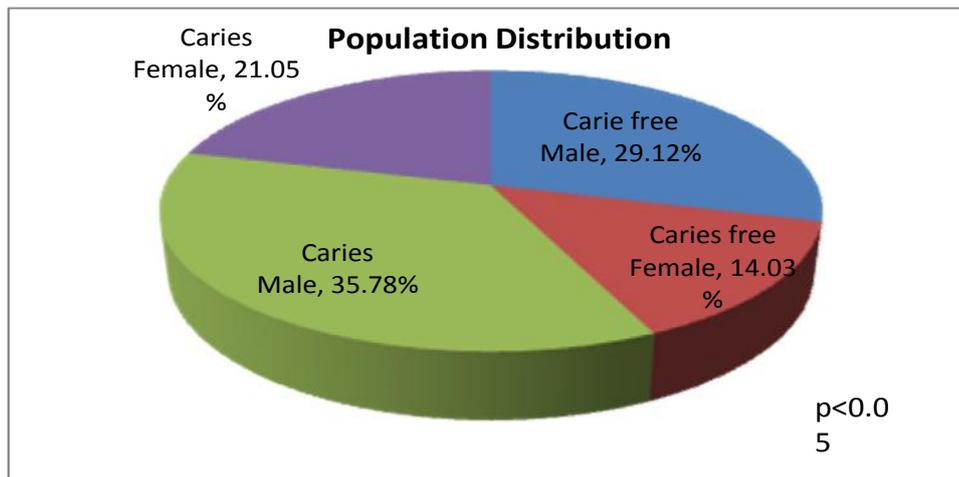
**Figure 2:** Shows the area marked for prominent ridges for total ridge count.



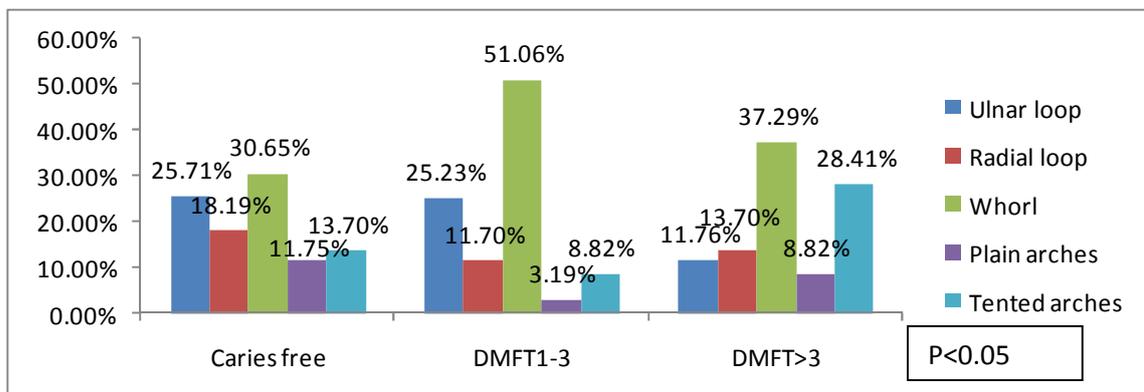
**Figure 1:** Shows different finger print patterns. A. Radial, B. Ulnar Loop, C. Whorl, D. Plain Arch, E. Tented Arch.

**Statistical analysis:** After recording fingerprints and dentition status the subjects were divided into three categories DMFT=0, DMFT=1-3 and DMFT>3 groups. The data

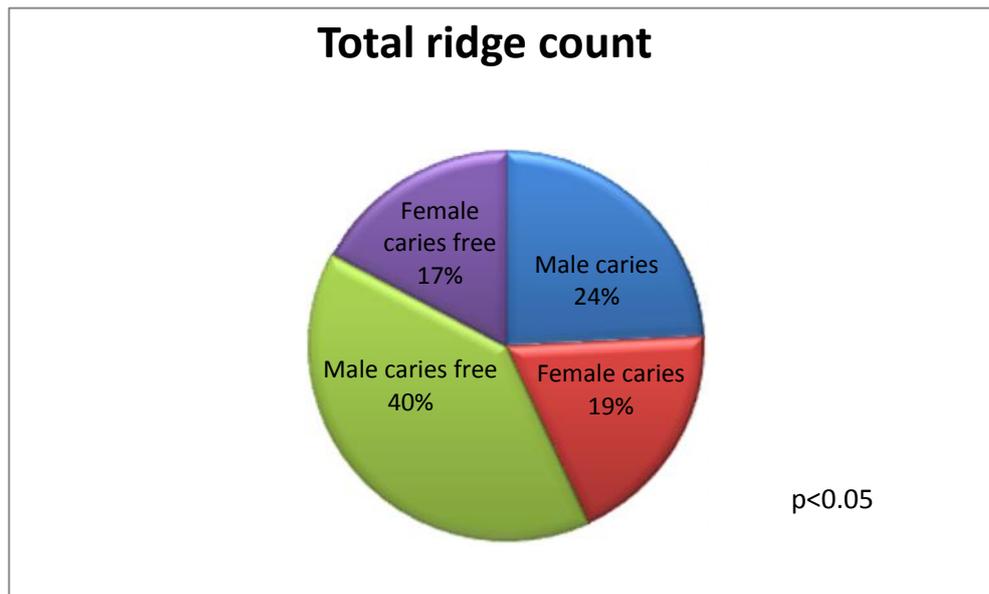
was analyzed using SPSS software version 17.0 and chi-square test was applied for data analysis.



**GRAPH 1:** Shows the gender wise distribution of participants with and without caries.



**Graph 2:** Distribution of the participants according to DMFT value and types of finger prints.



**GRAPH 3:** Frequency distribution of the participants according to caries status and total ridge count.

## RESULTS

The study was conducted on 276 school children of 12-15 years of age to determine the association between the finger prints and dental caries. In the current study 157 (56.83%) participants were having caries (Male=35.78% and Female= 21.05%) and 119 (43.17%) school children were caries free (Male= 29.12% and Female=14.03%) (Graph1). When the distribution of the participants according to DMFT value and types of finger prints was assessed, it was observed that in the caries free group 43.9% participants were found to have loop pattern (Ulnar group= 25.71% and Radial group=18.19%) and 30.65% of the participants were having whorl pattern whereas arch pattern was found amongst 33.86% participants.

Whorl pattern was found highest amongst participants having dental caries. 51 (51.06%) participants categorized under DMFT 1-3 were having whorl pattern and 22 (37.29%) participants having DMFT>3 were found to have whorl pattern (Graph 2). In the current study, Caries free participants showed increased Total Ridge Count (57%) especially in Males (40%), than in participants with caries group (Graph 3).

## DISCUSSION

The development of dermatoglyphic patterns begins with the appearance of fetal pads in

the 6th week of gestation and finishes with the appearance of patterns on the surface of the skin in the 24th week of gestation.<sup>16</sup> From this stage onwards, they remain unchanged. Dermatoglyphics is considered as a window of congenital abnormalities and is a sensitive indicator of intrauterine anomalies.

The dermatoglyphic patterns have been used as an oral health marker, which can determine the genetic predisposition of children to dental caries.<sup>5</sup> There are numerous genetically determined host resistance and risk factors for dental caries in an individual. Individuals with high resistance to dental caries had a specific immunoglobulin within saliva conveying immunity by lysing the cariogenic bacterial cells.

It was suggested that this phenotype was inherited and transmitted as an autosomal dominant trait.<sup>8</sup> Several reports and studies have also shown significant heritability for several microorganisms, including streptococci. Thus, genes and genetic abnormalities that leads to abnormal structural organization of teeth and its environment result in increased susceptibility to dental caries.

Studies conducted by Abhilash (2012)<sup>2</sup> and Singh (2016)<sup>8</sup> had reported an association between finger patterns and dental caries. In

the present study participants with increase in the whorl pattern, has an increased susceptibility to dental caries, this finding is in accordance with the studies conducted before by Abhilash (2012)<sup>2</sup> and Singh (2016)<sup>8</sup>, whereas this finding is in contrast with the study conducted by Sengupta (2013)<sup>12</sup>, where participants with caries mainly had loop pattern. In the studies conducted by Ahmed et al. (2010)<sup>22</sup> and Sharma and Somani (2009)<sup>17</sup> showed the similar results with the present study where children under caries free group were found to have increased loop patterns compared to caries free group. Highest Total Ridge Count was found amongst caries free group compared to children with caries this finding of the present study is in accordance with the study conducted by Metin (1998)<sup>21</sup> and Madan et al (2011)<sup>10</sup>.

**CONCLUSION:** Dermatoglyphics can be effectively used to understand genetic basis of numerous conditions like dental caries, malocclusion, cleft lip and palate etc. the present study shows that it is an effective and cost effective/ inexpensive tool to predict dental caries. In the current study whorl pattern was strongly associated with participants with dental caries and loop pattern was more found amongst non carious participants. Since, dermatoglyphics is still not a very reliable method in the present time, further research and studies in this field are required to determine and to evaluate the significance of these variations in the dermatoglyphic features of patients with dental caries.

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