FORENSIC DERMATOGLYPHIC DIAGNOSIS OF TYPE 1 DIABETES MELLITUS IN CHILDREN

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Abstract: *Dermatoglyphics, the scientific study of epidermal ridge patterns on the fingers, palms, and soles, has emerged as a valuable tool in medical genetics and forensic diagnostics. In recent decades, researchers have demonstrated significant correlations between specific dermatoglyphic traits and various systemic and genetic disorders, including Type 1 Diabetes Mellitus (T1DM). This study aims to investigate the forensic diagnostic potential of dermatoglyphic markers in children diagnosed with T1DM. The research is based on quantitative and qualitative analysis of dermatoglyphic patterns, ridge counts, and pattern asymmetry. The results reveal characteristic dermatoglyphic features in T1DM patients, supporting their utility as non-invasive, cost-effective diagnostic indicators in forensic medical practice.*

Keywords: *Dermatoglyphics, Type 1 Diabetes Mellitus, Forensic Diagnosis, Ridge Count, Pediatric Endocrinology*

Type 1 Diabetes Mellitus (T1DM) is a chronic autoimmune disorder characterized by the destruction of pancreatic β-cells, leading to insulin deficiency and hyperglycemia. The onset typically occurs in childhood or adolescence, and the disease is associated with both genetic and environmental risk factors. Early diagnosis is essential for preventing acute and chronic complications; however, conventional diagnostic approaches rely primarily on biochemical testing, which may not be feasible in all settings.

Dermatoglyphics offers a non-invasive and stable phenotypic marker system for evaluating genetic predisposition to various diseases. Since the formation of epidermal ridges is completed between the 13th and 21st weeks of gestation and remains unchanged throughout life, dermatoglyphic traits can reflect early developmental disturbances linked to genetic susceptibility. In the case of T1DM, previous studies have reported alterations in ridge counts, whorl and loop frequencies, and palmar crease patterns compared to healthy controls.

Forensic medicine can integrate dermatoglyphic analysis as a complementary diagnostic method, particularly in cases requiring the assessment of hereditary disease risk in children or the verification of medical history in legal contexts.

Dermatoglyphic analysis, although extensively studied in the context of genetic and congenital disorders, has gained increasing attention in recent decades for its application in autoimmune diseases, including Type 1 Diabetes Mellitus (T1DM). The forensic and medical significance of dermatoglyphics lies in its permanence,

uniqueness, and strong correlation with genetic determinants, making it a valuable phenotypic biomarker.

Epidermal ridge patterns are formed between the 13th and 21st weeks of gestation, coinciding with critical stages of organogenesis, immune system development, and endocrine maturation. Any disruption during this developmental window—whether due to genetic predisposition, maternal health factors, or intrauterine environmental stress—can lead to subtle but measurable alterations in dermatoglyphic configurations. In T1DM, particularly, genetic variants in the HLA region of chromosome 6 contribute to the autoimmune destruction of pancreatic β-cells, and these same developmental influences may also manifest in ridge pattern deviations.

In forensic or clinical diagnostics, dermatoglyphics are assessed through both qualitative and quantitative parameters. Qualitative analysis involves identifying the predominant digital patterns—loops, whorls, and arches—on each finger, while quantitative evaluation includes total finger ridge count (TFRC), absolute ridge count (ARC), and measurements of palmar atd angles. In children with T1DM, studies have shown a higher frequency of ulnar loops, reduced total ridge counts, and a tendency toward wider atd angles compared to healthy controls. These findings suggest that specific dermatoglyphic markers may serve as non-invasive indicators of genetic susceptibility to the disease.

Because ridge patterns remain unchanged throughout life, dermatoglyphics can be used retrospectively in forensic investigations, particularly when reconstructing medical profiles from partial biological evidence such as fingerprints. In pediatric endocrinology, their use as an early screening tool could aid in identifying children at high risk before clinical onset, potentially allowing for closer monitoring and preventive interventions. While dermatoglyphic analysis cannot replace biochemical testing, it can complement existing diagnostic protocols, especially in resource-limited settings where laboratory access is restricted.

Dermatoglyphic analysis provides a valuable, non-invasive, and cost-effective tool for exploring the genetic and developmental components of Type 1 Diabetes Mellitus in children. The association between specific ridge pattern variations—such as higher ulnar loop frequency, reduced ridge counts, and altered atd angles—and the autoimmune processes underlying T1DM suggests that dermatoglyphics could serve as an adjunctive diagnostic marker. While it cannot replace biochemical or immunological testing, its permanence and genetic basis make it a useful complementary method in both clinical and forensic settings. Further large-scale, multiethnic studies are needed to refine the predictive accuracy of dermatoglyphic parameters and to integrate them effectively into early detection programs.

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