Ectodermal Dysplasia: An Overview

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Abstract

Ectodermal dysplasia is a rare hereditary disorder with a characteristic physiognomy. It is a genetic disorder mainly striking the growth or purpose of the teeth,hair, nails and sweat glands. Ectodermal dysplasia can also affect the skin, the lens or retina of the eye, partsof the inner ear, the growth of fingers and toes, the nerves and other parts of the body providing to thes pecific syndrome. All the syndrome generallyinvolves a different combination of symptoms, which can range from mild to severe. The antiquity andlessons learned from hypohidrotic ectodermaldysplasia (HED) can serve as an example for investigating the root and pathogenesis of other ectodermal dysplasia syndromes by denoting that phenotypically identical syndromes can be caused by mutations in different genes, mutations in the same gene can lead to different phenotypes and that mutations in the genes further ensue in the same indicating pathway may alter the phenotype quite profoundly. This paper aims to describe and discuss the etiology, genetic review, clinical manifestations and treatment options of this hereditary disorder.

Keywords: *Ectodermal dysplasia; Symptoms; Genetic disorder; Therapeutics.*

Introduction

The term Ectodermal Dysplasia (ED) used to a geneticchange in the ectoderm, which is characterized by faulty growth during embryogenesis in one or moretissues. The syndrome is regarded as a change of sex-linked recessive trait, while some forms of abnormality can betransmitted as autosomaldominant or recessive. According to some authors,there are two types of ED: Anhidrotic or hypohidrosis,called Christ-Siemens-Touraine Syndrome, and hidrotic, called Cloustonsyndrome. The anhidrotic was first described by Thurnam in 1848 and later by Darwin which is generally transmitted by a recessive gene linked to chromosome X. Women is the carrier of this gene and the disorder is generally seen in men,denoted by the deprivation of some dental elements, dental abnormalities like conical teeth, lack of body hair, nailmalformation and decreased sweating, and specific facialfeatures[1]. Hypohidrosis is the mostobvious feature of this type of ED consideringhidrotic ED is a rare autosomal dominant disorder characterized by dystrophic, alopecia nails, and palmhyperkeratosis. The teeth and face abnormalities rarely present, and sweating, although Coskun and Bayraktaroglustated the presence of sweat glands disorders. Ocular abnormalities include strabismus, premature cataracts, and conjunctivitis. Otherabnormalities seenare hearing reduction, polydactyly, and syndactyly. Mental development is delayed. It isevaluated that the frequency of the male population is 7:10,000 births. By compromising these individuals self esteem the social life can be changed,especially if it is a child. Loss of vertical dimension and the lip,resulting from improper development of the alveolar process lump which is caused by the absence of some dental elements is some other consequences of thisanomaly.[2] Dental changes related to ED manifest early,can be easily detected in childhood. Since patients with these conditions are

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usually withdrawn, shy and complexso the detection should be done as soon aspossible so that the treatment can lead to physicalemotional and social development. Treatment of patients with the syndrome is complex and must have essential action and monitoring while the development of the child to the adult stage, to raise self-esteem and restore maximum functional and aesthetic. Dental defects represent a core clinical feature of many EDs: anodontia, polydontia, dysplasticteeth, retained primary teeth, deficient enamel development (amelogenesisimperfecta), dentine deficiency (dentinogenesisimperfecta), and underdevelopment of the alveolar ridge. In some EDs, the number of erupted teeth is reduced, the spacing of the teeth disrupted, and the periodontium is affected. There are a defect of the central nervous system (CNS), the adrenal medulla the oral, nasal and rectal mucosa and their associated glands. The pharyngeal and laryngeal mucosa may be so, atrophic that it results in dysphonia and hoarseness of voice.[3]

Etiology and Frequency: Hypohidrotic ectodermal dysplasia (HED) is usually passed on as an X-linked recessive trait where the female is the carrier and is manifested in males. In X-linked form carrier mothers show minimum expression in the form of hypodontia and/or conical teeth and decreased sweating. As a carrier, the female who is not affected has a 50% chance of transferring this condition to her male child. Likewise each female offspring has a 50% chance of inheriting the diseased gene. Rapid mutation of genes is possible and can be seen in any family without any history of this condition. The prevalence in the population has been assessed as between 1:10,000 and 1:100,000 male live births. A variety of ectodermal dysplasia is caused by the mutation or deletion of particular genes that are being located in different chromosomes. As ectodermal dysplasia is caused by genetic/hereditary defects, it can be passed down to the family line. It is not necessary to have a history everytime, this can be also seen in person without any past/genetic history of ectodermal dysplasia. In this condition *de novo* mutation has taken place. Genes responsible for ectodermal dysplasia are **EDA, EDAR, EDARADD**. Mutation in *EDA, EDAR, EDARADD* gene cause hypohidroticectodermal dysplasia. In x linked hypohidrotic ectodermal dysplasia EDA is only responsible. Both *EDA, EDARADD* are associated with both autosomal and recessive forms of hypohidrotic ectodermal dysplasia.[4,5]

Genetic Pathogenesis: During embryogenic development, *EDA, EDAR, EDARADD* gene provides instructions for making proteins. These proteins (Ectodysplasin A) form a part of an indicating pathway that is censorious for the interconnection between two cell layers, the ectoderm and the mesoderm. During embryogenesis; the initial stage of the embryo, the basis for many of the body organs and tissue are formed by these cell layers. The formation of various structures that emerge from the ectoderm which involve the skin, hair, nails, teeth, and sweat glands are because of ectoderm and mesoderm interactions. When mutation occurs in *EDA, EDAR, EDARADD* gene result in faulty ectodysplasin A formation which thereby intercept normal interconnection between the ectoderm and the mesoderm and teeth. The improper formation of this ectodermal structure leads to the characteristic feature of hypohidrotic ectodermal dysplasia.[4,5]

Classification: According to Freire-Maia"s classification, EDs aredivided into two groups: ***Group A***which consists of all the entities withdefects in two or more of the standard structures, and ***Group B*** comprises of those with disturbances inonly one of these structures plus another ectodermaldefect.11 subgroups have been included in Group A depending on the involved structures: 1-2-3-4 (hairteeth-nailssweat glands); 1-2-3 (hair-teeth-nails); 1-2-4 (hair-teethsweat glands); 1-3-4(hair-nails-sweat glands); 2-3-4(teeth-nails-sweat glands); 1-2 (hair-teeth); 1-3 (hairnails); 1-4 (hair-sweat glands); 2-3 (teeth nails); 2-4 (teeth-sweat glands); 3-4 (nails-sweat glands). Similarly,Group B is classified into four subgroups with number 5 added at the end, depicting that another ectodermal anomaly is present: 1-5, 2-5, 3-5, and 4-5. Other ectodermal derived structures like mammary glands,thyroid gland, thymus, anterior pituitary, adrenal medulla, central nervous system, external ear, melanocytes, cornea, conjunctiva, lacrimal gland and lacrimal duct that may also be involved in EDs.[4-6]

Hypohidrotic Ectodermal Dysplasia: Alteration in the gene **ectodysplasin** causes Christ-Siemens-Touraine syndrome which is the most common form of ectodermal dysplasia. Ectodysplasin is located at Xq12-13, which encodes for a transmembrane protein called ectodysplasin composed of 391 amino acids. X-LHED is caused by mutation in the ectodysplasin gene. EDAR is mapped to 2q11-q13, has been implicated in an autosomal dominant and recessive form similar to X-LHED. EDAR acts as a receptor for ectodysplasin.[7]

Hidrotic Ectodermal Dysplasia: Hidrotic ectodermal dysplasia is also known as cluster syndrome. Mutation in connection gene, GJB6 causes this condition. Both males and females are equally affected. Hair loss, nail dystrophy & palmoplantar keratoderma are the characteristic features of this syndrome. Hair growth becomes very less resulting in atrichia or hypotrichosis.[8]

Clinical Manifestations: During the 1st trimester of pregnancy ectodermal dysplasia is usually seen. In severe form; it is seen before the 6th week of embryonic life where the dentition gets affected. Ectodermal structures get affected after the 8th week. Hypohidrosis is the exceptional feature of hereditary ectodermal dysplasia. HED is a clinically homogeneous condition along with major involvement of ectodermal structures in perturbed formation and maturation of teeth, hair, nails and sweat glands. Genetic studies have identified 4 subtypes of HED, by splitting the autosomal dominant and recessive form into 2 distinct entries caused by mutations in either EDAR, EDARADD Gene's. Children with hypohidroticectodermal dysplasia will have fine, scanty, light coloured hair that thickens and darkens as the patient grows up.Oligodontia of primary and permanent teeth is the most distinctive feature. Tooth are usually of conical shape. Teeth are missing both in maxilla and mandible but with a higher incidence rate in mandible. Maxillary retrusion is seen in children due to sagittally under developed maxilla.[9]

Therapeutic Aspects: A person with ectodermal dysplasia usually suffers from poor psychological and physiological development which is a result of unacceptable aesthetic and abnormal function of orofacial structures. Early treatment is suggested. Ideal treatment requires integrated efforts from pediatric doctors, psychiatrists, ENT specialists, and speech therapist. To improve appearance, mastication and speech dentist is solely responsible. Dental treatment depends on the severity of the condition. According to age, growth, and development of stomatognathicsystems of the patient the treatment varies. The goal of a pedodontist is to provide the child with an oral appliance that will provide the ideal aesthetic and function to allow the patient to develop physically, emotionally, and socially. [1-5]

For the child's growth and development consistent dental treatment is required. The ideal pattern of treatment consists of fabrication of dentures, and as the child grows the denture will be modified or replaced. During the mix dentition period, the prosthesis will require modifications to accommodate the loss of exfoliated primary teeth and the appearance of newly erupted permanent teeth. During permanent dentition, the removable prosthesis maybe replaced by fixed depending on the number and position of the teeth. Another treatment option is the use of implants. In adult use of implant has been seen but there are no clinical reports of use of the implant in growing children. [3-6]

Conclusion

Diagnosis of ectodermal dysplasia is solely based on lack or type of hair, absence of teeth and tooth buds and tooth morphology. Eczema, asthma and frequent respiratory infections may provoke the disease. Ectodermal dysplasia is a diverse group of inherited disorders that have many overlapping features. It is difficult to classify them. The clinical manifestations of ectodermal dysplasia cause significant social problems in affected individuals. Both oral and body functions are affected. A prompt diagnosis and rehabilitation by the multidisciplinary approach is the key to successfully manage ectodermal dysplasia.

Unusual facial features exacerbate the social challenges of meeting new people. Lowered self-esteem, speech defects, decreased academic performance and social isolation may result from merely looking different from one's peers. Therefore, cosmetic and prosthodontic measures should be introduced as early as possible to have the child resemble his peers. It is also important to inculcate awareness among parents regarding early management. To ensure adequate care, a child with ectodermal dysplasia should be managed by a team which includes pediatrician, pediatric dentist, prosthodontist, dermatologist, otolaryngologist, speech therapist, and psychologist. However, an appropriate change has to made in the denture so that the appearance is always appropriate for the age. Relining or change of dentures should be done every 1 or 2 years due to preadolescent growth in jaw dimensions, wear of the acrylic teeth, under the extension of the dentures and posterior open bite.

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References

1. Gopinath VK, Manoj KM, Mahesh K. Hypohidrotic

ectodermal dysplasia-A case report. J Indian Soc Pedod Prev Dent. 1999;17(3):90–92.

2. Suprabha BS. Hereditary ectodermal dysplasia: A case report. J Indian Soc Pedod Prev Dent. 2002 Mar: 37-40.
3. Chokshi A, Chokshi K, Chokshi R, Mhambrey S. Ectodermal Dysplasia: A Review. Int J Oral Health Med Res 2015;2(1):101-104.
4. Deshmukh S, Prashanth S. Ectodermal dysplasia: a genetic review. Int J Clin Pediatr Dent. 2012; 5(3):197–202. doi:10.5005/jp-journals-10005-1165
5. García-Martín P, Hernández-Martín A, Torrelo A. Ectodermal dysplasias: a clinical and molecular review. Actas Dermosifiliogr. 2013;104(6):451–470.
6. Memarpour M, Shafiei F. Witkop tooth and nail syndrome: a report of three cases in a family. Pediatr Dermatol. 2011;28(3):281–285.
7. Visinoni AF, Lisboa-Costa T, Pagnan NA, Chautard-Freire-Maia EA. Ectodermal dysplasias: clinical and molecular review. Am J Med Genet A. 2009; 149A(9):1980–2002.
8. Lamartine JT King NM. Ectodermal dysplasia: A review and case report. Quintessence Int. 1997; 126(8):1075-9
9. Wright JT., Grange DK., Ritcher MK. Hypohidrotic ectodermal dysplasia. Gene Reviews. NCBI Book Shelf. Updated. 2009.