Hypohidrotic ectodermal dysplasia: Characteristics and treatment

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Hypohidrotic ectodermal dysplasia is a rare congenital disease that affects several ectodermal structures. The disease is usually transmitted as an X-linked recessive trait in which the gene is carried by the female and manifested in the male. Manifestations of the disease differ in severity and may involve teeth, skin, hair, nails, and sweat and sebaceous glands. Most affected children require extensive dental treatment to restore their appearance and help the development of a positive self-image.

(Quintessence Int 1995;26:285-291.)

Introduction

Hypohidrotic ectodermal dysplasia (HED) is a rare, hereditary congenital disease that affects several ectodermal structures. This syndrome is generally regarded as consisting of a triad of symptoms: hypotrichosis, hypohidrosis, and hypodontia. Parents often report that the pediatrician was unaware of the child's condition and that the pediatric dentist was the first to diagnose it, because of the oral manifestations. The purpose of this article is to review the characteristics of this disease and its treatment, demonstrating the necessity of a team approach for the optimal care of these children.

Classification

The ectodermal dysplasias (EDs) are a phenotypically heterogeneous group of disorders that affect tissues of ectodermal origin and occasionally those of nonectodermal origin. The outer layer of cells in a developing embryo consists of ectoderm. Structures formed from the ectoderm include the teeth, the epidermis and appendageal structures, the nervous system, and organs of the special senses. Children with ED may have various manifestations of the disease that differ in severity and that may or may not involve teeth, skin, hair, nails, and sweat and sebaceous glands, making classification of ED difficult.

The EDs may be defined as conditions with at least one of the following four features—trichodysplasia, dental defects, onychodysplasia, or dyshidrosis—as well as at least one sign showing involvement of another structure of ectodermal origin. Controversy exists over which syndromes should be classified as ED. Many variations of ED exist; estimates indicate that there are more than 120 types, inherited through all mendelian modes. Among the more common syndromes are Ellis–Van Creveld syndrome (chondroectodermal dysplasia), cranioectodermal dysplasia, incontinentia pigmenti, ectrodactyly-ectodermal dysplasia-cleft lip/palate syndrome, and Rapp-Hodgkin ectodermal dysplasia. Hypohidrotic ectodermal dysplasia, also known as Christ-Siemens-Touraine syndrome and anhidrotic ectodermal dysplasia, is the most common syndrome and therefore is the focus of discussion of this article.

Historically, data describing ED dates back to Darwin, who reported that ED was observed as early...
as 1838. Christ, in 1913, defined it as a *congenital ectodermal defect*, and Weech, in 1929, impressed by the depression of sweat gland function, termed it *anhidrotic ectodermal dysplasia*. Felsher, in 1944, pointed out that the skin is rarely, if ever, completely anhidrotic and correctly labeled the syndrome *hypohidrotic*.5

**Etiology and frequency**

Hypohidrotic ectodermal dysplasia is usually transmitted as an X-linked recessive trait in which the gene is carried by the female and manifested in the male. However, at least 35 females have exhibited the complete syndrome, and it is probable that most of these cases are examples of the autosomal-recessive form of the condition. In the X-linked form, carrier mothers exhibit minimal expression of the gene in the form of hypodontia and/or conical teeth and spottily reduced sweating (Fig 1). The unaffected female has a 50% chance of transmitting this disorder to her male children, and each female offspring has a 50% chance of inheriting the defective gene, thereby being a carrier. Spontaneous gene mutation is possible, and HED may occur in a family without any previous history of the syndrome.7 The prevalence in the population has been assessed as between 1:10,000 and 1:100,000 male live births.8

**Clinical features**

The characteristic facial features of a child affected by ED consist of a prominent forehead, sparse and fine blonde hair, a depressed nasal bridge, thick everted lips, hypodontia, and conical teeth (Figs 2a and 2b). These facial characteristics may be striking, subtle, or almost absent.9 The skin is dry because of a deficiency of the sweat glands. Periorbital wrinkling and pigmentation may occur. Subcutaneous fat is often diminished or absent, as are the mucous glands in the respiratory and gastrointestinal tracts.8

The decreased number of sweat glands may cause heat intolerance, and frequent high fevers are often misdiagnosed as fevers of unknown origin. The decreased number of mucous glands is associated with otolaryngologic problems.11,12 Associated features may also include nasal disturbances, atrophic rhinitis, chronic pharyngitis, recurrent episodes of asthma, epistaxis, hearing loss (resulting from an accumulation of wax in the auditory canal), and decreased production of bodily fluids, including saliva.2,4 Although mental retardation is seen in some rare forms of ED, it is not a primary feature of HED. Some investigators have suggested mental retardation may occur secondary to recurrent episodes of hyperthermia.13

The associated dental abnormalities have been documented extensively in the dental literature and may include complete absence of both primary and permanent dentitions9,14-17 or, more commonly, a reduction in the number of teeth. Teeth may also be morphologically defective, assuming a conical or peg shape. Other defects include enamel hypoplasia, which may increase the susceptibility of the teeth to caries. The absence of teeth results in decreased development of alveolar bone and may give the child a distinct, aged facial appearance similar to that of the edentulous elderly patient.

**Diagnosis**

Diagnosis of HED is based on episodes of hyperpyrexia, the lack or type of hair, the absence of teeth and buds, and the tooth morphology. Peeling of skin at birth, eczema, and asthma or frequent respiratory infections may be additional clues. However, during early infancy diagnosis is difficult because manifestations of HED involving the teeth and hair and inability to sweat are hard to detect. Consequently, diagnosis is often not made until a delay in tooth eruption is detected (Table 1).

Hypodontia can occur alone or as part of a syndrome. Many syndromes manifest in a reduction in the primary or permanent dentition. A thorough family medical history coupled with a clinical examination will narrow down the spectrum of possible etiology of hypodontia. If an ectodermal syndrome is suspected, a family pedigree should be constructed. More than 120 varieties of ectodermal dysplasia have been described, but only a few may cause confusion in diagnosis. The key to distinguishing between the syndromes, besides obvious clinical manifestations, is the pattern of inheritance. Hypohidrotic ectodermal dysplasia is usually inherited via an X-linked recessive mode. A simple family tree or pedigree may aid the clinician in distinguishing HED from the other, less common, EDs, which are usually inherited in autosomal-dominant or autosomal-recessive patterns. Female carriers may be identified in at least 70% of cases by clinical examination.11 Dental examination alone may reveal carriers (see Fig 1), and more may be recognized by examination of sweat pores.8 Detecting the
The mother of a child with hypohidrotic ectodermal dysplasia, a probable carrier of ectodermal dysplasia, exhibits conical lateral incisors. The mother also has dry skin.

A 4-year-old boy with hypohidrotic ectodermal dysplasia exhibits a relatively short lower facial height and hypodontia, as well as sparse hair and eyebrows, everted lips, depressed and broad-saddled nose, and prominent ears.

Female carriers will facilitate the diagnosis of their affected sons.

Medical treatment (Table 2)

Infants with HED may have dry and peeling skin. Feeding problems may result from crusts of nasal secretions, that obstruct the nose and later from anodontia. Episodes of fever in hot weather, recurrent chest infections, and eczema may occur. The recurrent episodes of hyperthermia or sepsis usually resolve.

Table 1  Approximate ages at which teeth can be expected to be visible on radiographs and in the mouth*

<table>
<thead>
<tr>
<th>Teeth</th>
<th>Radiograph</th>
<th>Oral cavity</th>
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<tbody>
<tr>
<td></td>
<td>Primary</td>
<td>Oral cavity</td>
</tr>
<tr>
<td>Incisors</td>
<td>Birth</td>
<td>6–9 mo</td>
</tr>
<tr>
<td>Canines</td>
<td>Birth</td>
<td>18 mo</td>
</tr>
<tr>
<td>First molars</td>
<td>Birth</td>
<td>12 mo</td>
</tr>
<tr>
<td>Second molars</td>
<td>Birth</td>
<td>24 mo</td>
</tr>
<tr>
<td></td>
<td>Permanent</td>
<td></td>
</tr>
<tr>
<td>Central incisors</td>
<td>6 mo</td>
<td>6–8 y</td>
</tr>
<tr>
<td>Lateral incisors</td>
<td>9–12 mo</td>
<td>7–9 y</td>
</tr>
<tr>
<td>Canines</td>
<td>6 mo</td>
<td>9–10 y in mand</td>
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<tr>
<td></td>
<td></td>
<td>11–12 y in max</td>
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<tr>
<td>Premolars</td>
<td>2–3 y</td>
<td>10–12 y</td>
</tr>
<tr>
<td>First molars</td>
<td>Birth</td>
<td>6 y</td>
</tr>
<tr>
<td>Second molars</td>
<td>4 y</td>
<td>11–13 y</td>
</tr>
</tbody>
</table>

* Adapted from Jorgenson.
Oral Pathology

Table 2  Total care for hypohidrotic ectodermal dysplasia

**Systemic**
- Control body temperature with tepid sponging, showers, cold drinks, air conditioning, antipyretics, and wet clothing (especially during sports).
- Treat and prevent infections (caused by decreased number of mucosal glands in respiratory and gastrointestinal tracts).

**Feeding**
- Feeding problems (found in 70% of patients) result from nasal crusting (in 80% of patients) and lack of teeth and saliva. Heated drinks and dry foods may cause difficulties (which can be alleviated with dentures, artificial saliva, and moist foods).

**Growth and development**
- Monitor growth. Short stature is not inevitable and warrants full investigation.
- Monitor speech and hearing. Early dental treatment may help speech, confidence, and nutrition.

**Other**
- Asthma (found in 65% of patients) and eczema (found in 70% of patients) require standard treatments.
- Deficient lacrimal secretions require eye drops.
- Genetic counseling provides necessary support.

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Spontaneously, and growth and development proceed normally. Older children should be subjected to temperate control by air-conditioned surroundings, frequent cool drinks, and cool showers during summer. These children lack perspiration and have an intolerance to heat; hyperpyrexia may occur after only mild exertion or even following meals. Because they have less subcutaneous fat, some children with HED may suffer in cold climates as well. Although dentures must be replaced frequently throughout the growth period, the beneficial effects of intervention usually outweigh the cost. With dentures in place, the child begins to enjoy a wide variety of food. Articulation improves, and the pleasing cosmetic affect enhances self-esteem (Fig 2c). Children are taught oral hygiene and how to care for their appliances. Success is possible with children as young as 3 years of age.

Treatment of a child with ectodermal dysplasia requires knowledge of growth and development, behavioral management, the fabrication of a prosthesis, the modification of existing teeth with resin composites, the motivation of the patient and parent in the use of the prosthesis, and long-term follow-up for the modification and/or replacement of the prosthesis.

After the initial examination, the dentist usually will recommend one or more of the following procedures:

1. Delayed treatment
2. Removable partial or complete dentures (Fig 3)
3. Resin composite (bonding) cosmetic modification of the existing teeth
4. Fixed prostheses
5. Osseointegrated implants
Dental treatment is an ongoing and active process that must be adapted constantly to the child's growth and development. The usual pattern of treatment consists of fabrication of an overdenture for a patient as young as 3 years of age. As the child grows, the denture will have to be modified or replaced. During the patient's mixed-dentition stage, the prosthesis will need to be modified to accommodate the loss of exfoliated primary teeth and the appearance of newly erupted permanent teeth. When the patient is in the permanent-dentition stage, the removable prosthesis may be replaced by a fixed restoration, depending on the number and position of the remaining permanent teeth.

The use of osseointegrated titanium implants that are surgically placed in the jaw may be used. These implants become a basis for permanent anchoring, and a fixed or semifixed denture can be fabricated. The use of implants in children has not been fully investigated, and their use should be postponed in children under 13 years. Although it may be possible to place implants in very young children, there is no reason to do so. Children adapt readily to removable prostheses with proper preparation and motivation. Because osseointegrated implants do not have an associated periodontal ligament, a fixture placed in a child aged 7 or 8 years may not be in a favorable position when the patient reaches the age of 16 years. In addition, there is little long-term clinical experience with implants in the restricted anatomic conditions found in young children with ED. Another restricting factor is the additional expense of frequently remaking an implant-supported prosthesis as the child matures.

Discussion

Optimal treatment for children with ED requires the multidisciplinary collaborative efforts of pediatric professionals. The role of the pediatrician should be one of team leader. The initial diagnosis should be made by the pediatrician when the patient suffers from unexplained episodes of fever and/or intolerance to heat and lacks teeth. The pediatrician should be familiar with the eruption time and sequence of the primary dentition. When teeth are missing, the patient should be referred to the pediatric dentist for appropriate radiographic examination. This will enable the clinician to determine if teeth are congenitally missing or simply delayed. The presence or absence of developing permanent tooth buds will also be detected (Fig 4). The concern of parents of a child with unerupted teeth usually can be alleviated by this simple radio-graphic examination.

Referral to a geneticist for confirmation of the diagnosis and family counseling then is indicated. The team should also include a psychologist, who will play a key role in helping the child deal with the problems of ED. In addition, throughout childhood, the child may
need to be treated by an ear, nose, and throat specialist for hearing problems, the pediatric dermatologist for proper care of the characteristic dry skin and frequent episodes of eczema, and by a speech therapist for correction of any speech disorders. The child's dental needs will change as growth continues, and continuous dental care will also be needed.

In a letter to a pediatric dentistry journal, the mother of a child with ectodermal dysplasia pleaded to the private dental establishment to treat children who have ED and not turn them away. Parents assert that their children lack a health care provider who could refer the child to the pediatric dentist, geneticist, and other specialists. Many general dentists may be reluctant to attempt to treat the young child with ectodermal dysplasia, because the treatment usually consists of dentures, which are believed to be complicated. Most dentists have received little if any training in the management and fabrication of a prosthesis for the pediatric patient, especially the pediatric patient with a minimal foundation for an oral prosthesis. Parents should not be discouraged by a dentist who says that treatment is not possible, and they should not hesitate to get a second opinion.

The National Foundation for Ectodermal Dysplasia serves as a valuable resource for patients, parents, and professionals. It publishes guides and booklets for parents and physicians. Optimal comprehensive care of children with HED can be achieved by proper cooperation and communication among professionals in the relevant disciplines.

References


