International Journal of Paediatric Dentistry 2005; **15:** 364–369

Witkop tooth and nail syndrome: a case report

S. DEVADAS[1], B. VARMA[1], J. MUNGARA[1], T. JOSEPH[1] &
T. R. SARASWATHI[2]

[1]*Department of Paediatric and Preventive Dentistry and* [2]*Department of Oral Pathology, Ragas Dental College and Hospital, Chennai, India*

Summary. Witkop tooth and nail syndrome is an autosomal dominant ectodermal dysplasia characterized by hypodontia and nail dysplasia. Mutations in MSX-1 have been identified as being involved in the syndrome. Mandibular incisors, secondary molars and maxillary canines are the most frequently missing teeth. Tooth shape may vary, and conical and narrow crowns are common. Nail dysplasia affects finger- and toenails, and is often more severe in childhood. Nails may be spoon-shaped, rigid, slow-growing and easily broken. The clinical and radiographic features of a mother and child presenting with this rare condition are described.

Introduction

The ectodermal dysplasias are a clinically and genetically heterogeneous group of more than 120 syndromes involving ectodermally derived structures [1]. The syndrome that is autosomal dominantly inherited and characterized by hypodontia, dysplastic nails and normal hair is known as hypodontia–nail dysplasia syndrome or tooth and nail syndrome (TNS). This rare genetic disorder that belongs to a group of diseases known as ectodermal dysplasia was first described by Witkop in 1965 [2]. Tooth and nail syndrome affects males and females in equal numbers. One to two in every 10,000 individuals may be affected by TNS. It has been reported that the disorder appears to be prevalent among the Dutch Mennonites of Canada [3].

Tooth and nail syndrome is characterized by hypodontia, and/or malformation of primary and permanent teeth occurring in association with dysplasia of the nails, particularly the toenails. Primary teeth and/or permanent teeth are widely spaced or conical in shape, i.e. coniform. In infants with the syndrome, some nails may be absent at birth or grow extremely slowly particularly during the first 2–3 years of life. In addition, when the nails do begin to grow, they may be unusually small and hypoplastic with distinctive abnormal hollowing that causes them to appear spoon-shaped [4]. In most individuals with TNS, the toenails are more severely affected than the fingernails. Some individuals with TNS have scalp hair that is abnormally thin, fine and brittle. Heat tolerance and sweating are normal [5]. Mutation in MSX-1 has been shown to be associated with Witkop syndrome. This MSX is recognized to be important in tooth formation [6].

Diagnosis of TNS may be suspected at birth if one or more toe- and fingernails are absent, but the disorder is more often detected at approximately 4 or 5 years of age, when the absence of certain primary teeth and hypoplasia of nails is noted [7]. In some cases, diagnosis may not be confirmed until approximately 5 years of age, when the absence and/or malformation of several permanent teeth and nail dysplasia are also evident. A confirmation of the diagnosis of TNS is often based upon a thorough clinical evaluation and the identification of characteristic physical findings. The authors report Witkop tooth and nail dysplasia occurring in a child and her mother.

Case report

A 5-year-old Indian girl presented to the Department of Paediatric and Preventive Dentistry, Ragas Dental College and Hospital, Chennai, India, for evaluation

Correspondence: Dr Sheeba Devadas, c/o Dr T. M. Varghese, PO Box 27754, Old Passport Road, AbuDhabi, UAE. E-mail: drsheeba_das@hotmail.com

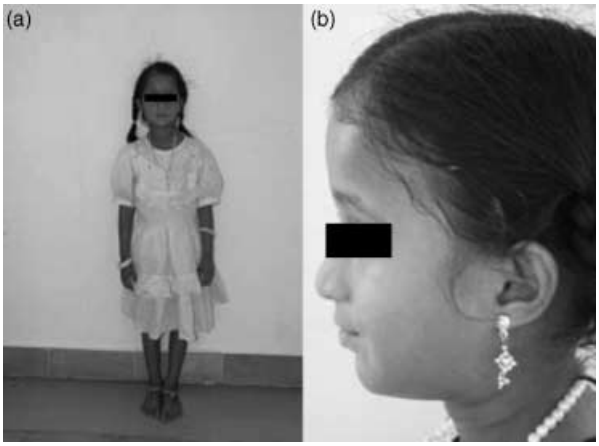

Fig. 1. Photographs of the subject showing (a) her short stature, and (b) her fine hair and receding hairline.

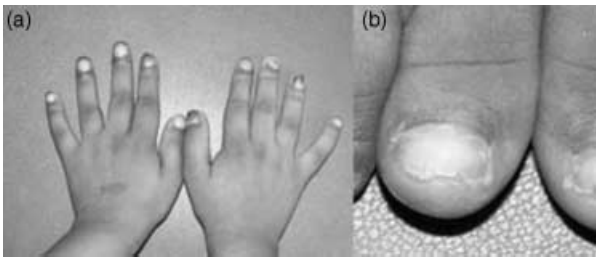

Fig. 2. Photographs of the subject showing (a) her hypoplastic fingernails and (b) her toenails.

and treatment of a left lower primary second molar. She was of short stature, being below the fifth percentile for height and weight (height = 97 cm, weight = 13 kg) (Fig. 1a). The subject's eyelids were slightly drooping and had prominent epicanthal folds. She had thin and brittle hair with a receding hairline, and mild frontal bossing (Fig. 1b). The hair of her eyebrows was scanty, but she had normal eyelashes. The subject's fingernails were hypoplastic, and her toenails were thin and easily chipped off (Fig. 2a,b). There were no apparent problems with heat intolerance or sweating. Haematological examination revealed normal thyroid levels and blood counts.

Intraorally, she presented with a complete primary dentition. The mandibular central and lateral incisors had tapering crowns (71, 72, 81, 82):

BA	AB

Her maxillary central and lateral incisors, first and second molars, and mandibular first and second molars

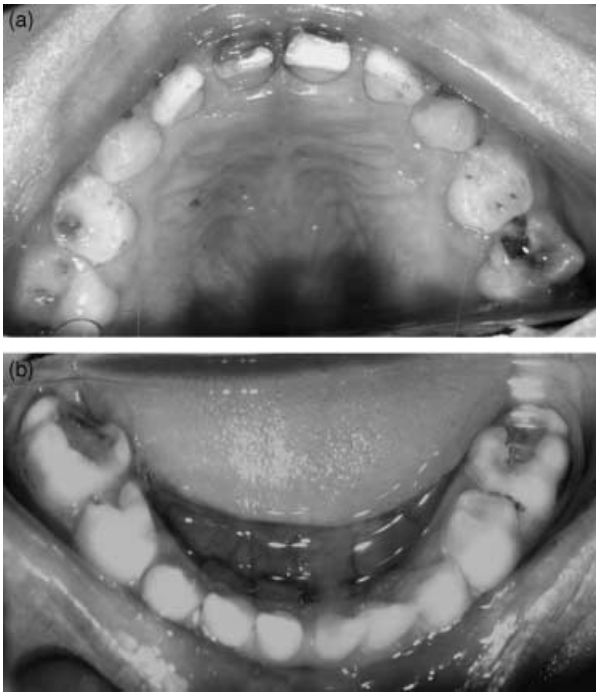

Fig. 3. Phograph of the subject showing (a) Maxillary dentition (b) Mandibular dentition.

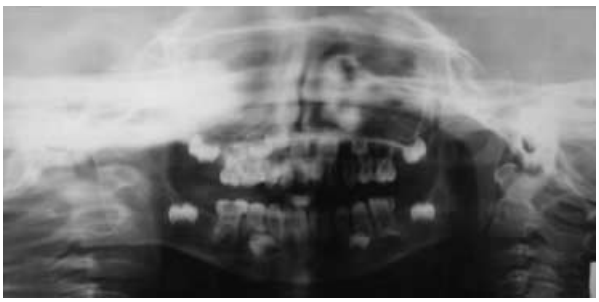

Fig. 4. Radiograph showing the subject's multiple missing teeth.

on either side were carious (51, 52, 61, 62, 54, 55, 64, 65, 74, 75, 84, 85) (Fig. 3a,b):

EDBA	ABDE
ED	DE

Radiographs revealed multiple missing permanent teeth (Fig. 4), including mandibular central and lateral incisors, mandibular canines, maxillary lateral incisors, and a maxillary left canine and second premolar (12, 22, 23, 25, 31–33, 41–43):

2	235
321	123

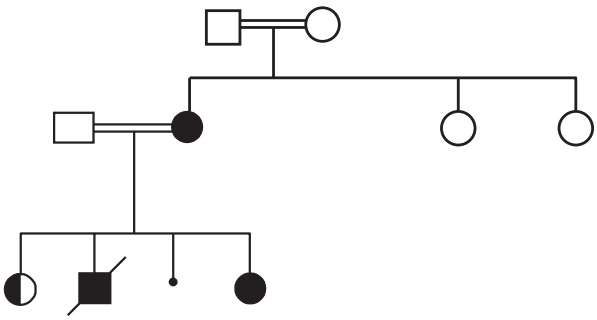

Fig. 5. Pedigree chart for the subject.

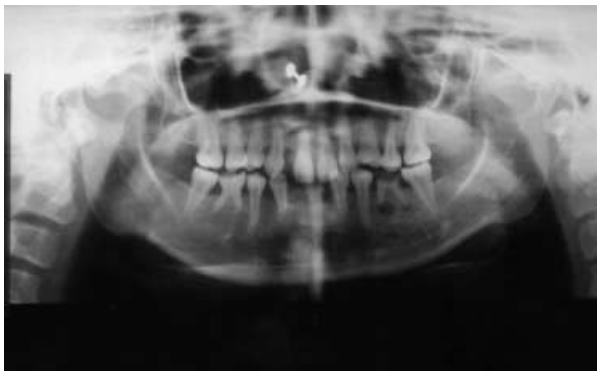

Fig. 6. Radiograph of the subject's mother's dentition.

There was generalized microdontia. Salivary flow appeared to be unaffected. The subject's tongue was smoother than normal. Orthodontic assessment showed that the child had a skeletal class II relationship with distal step, and retroclined upper and lower incisors.

Analysis of the jaw bases showed a sella-nasion-A point angle of 75°, a sella-nasion-B point angle of 70° and an A point-nasion-B point angle of 5°. The extent of the maxillary base is determined by measuring the distance between the posterior nasal spire and point A (PNS-point A) projected perpendicularly to the palatal plane. This was 41 mm in the subject and the mandibular base length (gonion to pogonion) was 57 mm. Analysis of the facial skeleton revealed an articular angle of 156°, a gonial angle of 120·5° and Jarabak's ratio of 72%, showing a horizontal growth pattern.

Both parents and a sibling were also examined (Fig. 5). The parents revealed a history of two siblings who had died previously, one as a consequence of stillbirth and the other who had been aborted.

The mother was of normal stature and had no relevant medical history. There was mild recession of her hairline, but her scalp hair, eyebrows and eyelashes were normal. She reported no problems with heat tolerance and sweating. Her finger- and toenails were normal. The family history of the mother was not contributory.

Intraoral examination revealed poor oral hygiene status, multiple missing permanent teeth and retained primary mandibular secondary molars (75, 85):

E	E

The mother's missing teeth were second molars, third molars and lateral incisors in both arches. In the mandibular arch, the central incisors and second premolars were also missing (12, 17, 18, 22, 27, 28, 31, 32, 35, 37, 38, 41, 42, 45, 47, 48). The mother reported that her mandibular central incisor and premolars had been lost as a consequence of their poor periodontal condition:

872	278
87521	12578

An orthopantamograph of the mother confirmed the absence of her mandibular right and left premolars, maxillary left lateral incisors, and second and third molars in all quadrants (Fig. 6). The first permanent molars had fused roots. Periapical radiolucency was present and associated with the mandibular right primary first molar (85):

E	

The father had no abnormal extraoral features. Clinical and radiographic examinations of the father revealed missing lower right central and lateral incisors, right canines, and premolars, but this was reported to be the result of trauma. Clinical examination of the patient's 9-year-old sister revealed normal extraoral features with a conically shaped mandibular left central incisor, but radiographs showed the presence of all permanent tooth buds.

The treatment plan advocated for the child was oral prophylaxis, pulp therapy and stainless steel crowns on the maxillary right second primary molar, the mandibular left first primary molar, and the left and right second primary molars.

Composite resin restorations and strip crowns were recommended for the maxillary and mandibular anterior teeth.

Lubrication of nails and trimming to keep them short and smooth were suggested to prevent fungal infections. Use of hair oil was also suggested to reduce the dryness of her hair.

Discussion

Witkop TNS is characterized by hypodontia and nail dysplasia in the absence of other ectodermal abnormalities. This autosomal dominant form may remain unrecognized in many patients because the appearance of the nails and other possible features is so mild that hypodontia may be the only presenting problem [4].

The scale of hypodontia in TNS reported in the past has varied from one or two missing teeth to severe hypodontia. The developmental absence of mandibular premolars and canines, as found in both patients reported here, is a frequent feature [3].

Nail dysplasia is one of the defining characteristics of this syndrome, but an improvement of nail condition with age is also common. This may be the reason that the mother of this child had apparently normal nails [5].

Short stature, drooping eyelids and prominent epicanthal folds, which were seen in this child, are additional features which are not normally seen in Witkop TNS. Short stature below the fifth percentile is more often an indicator of under-nutrition.

The anterior tooth shape has been described as parallel-sided and coniform in TNS, meaning that they have tapering incisal edges. In the case reported here, these features were present only in the child's primary dentition.

An orthopantamograph of the child revealed that no permanent second molars were present. These teeth may be congenitally missing or their development may be delayed, since the child is only 5 years of age.

Enamel defects have not been reported and were not seen here. Other features of ectodermal dysplasia, such as defective sweat production, were not present in this case.

Tooth and nail syndrome has been reported as having an autosomal dominant inheritance, and this pattern is seen here. The mother's missing teeth, receding hairline and lack of a problem with heat tolerance are features characteristic of Witkop TNS. The sibling's conically shaped mandibular left central incisor may also suggest that she is affected, but to a very mild degree. Thus, the features shown in the mother and daughter are consistent with report of autosomal dominant inheritance.

Various ectodermal dysplasias have been described. When compared to the X-linked recessive hypohidrotic ectodermal dysplasias, dental anomalies are less severe in TNS. The most common missing teeth in Witkop TNS are maxillary incisors, secondary molars and maxillary canines. Defects in primary teeth may be so mild that no abnormality is noted until the permanent teeth fail to erupt. Typically, defects of the nails are noted during childhood, but often disappear by adulthood.

Although seen here, hair defects are not specifically associated with Witkop TNS, but some patients have hair that is fine in texture and diffusely thin.

Fried TNS, deafness and onychoosteodystrophy with retardation (DOOR) syndrome and Curry–Hall syndrome are other ectodermal dysplasias with defects which are not only confined to the nails and teeth.

Fried TNS is a form of ectodermal dysplasia with the absence of several primary teeth, and/or abnormally small conical and peg-shaped teeth. It is characterized by abnormally thin fingernails, unusually small and thin toenails that may be curved inwards (concave), slow-growing fine scalp hair, and/or thin scanty eyebrows. The affected infants and children may appear to have an outwardly turned (everted) lower lip. Therefore, obtaining a family history is very important since Fried TNS may appear very similar to Witkop TNS clinically, but is inherited in an autosomal recessive fashion.

The DOOR syndrome comprises of sensorineural deafness, osteodystrophy, onychodystrophy, learning difficulties, seizures, hypoplastic nails and congenital bony anomalies.

Curry–Hall syndrome is a pleiotropic autosomal dominant disorder of polydactyly, conical teeth, nail dysplasia and short limbs.

Therefore, regular evaluation by a paediatrician and audiologist should be a part of the regimen for children manifesting any of these syndromes, followed by evaluation by a neurologist for learning disabilities and seizures, and genetic counselling.

Diagnosis of Witkop TNS in this case report was based mainly on clinical and radiographic findings, and pedigree of the family. Lack of appropriate genetic research facilities meant that confirmation by genetic tests was not an option. The long-term treatment plan comprises of routine dental care using oral health promotion strategies, together with periodic growth assessment and growth modification, if required.

Orthodontic values revealed a retrognathic mandible, but this is not an issue since at least some catch-up growth is likely.

A removable prosthesis may be required as the permanent teeth start to erupt. This will need to be regularly relined, rebased or remade to accommodate growth changes, and to maintain the patient's oral functions of speech, chewing and swallowing [11]. When the child reaches her teenage years, orthodontic treatment may be indicated, as a part of combined treatment, since consolidation of spaces may be needed to prepare the mouth for a fixed partial denture or implant in the future.

When growth has stabilized, osteointegrated implants may be an option to aid to support, stabilize and retain the prosthesis [12]. It is thought to be important to intervene with implants as early as possible, usually when the patients are in their late teens, once pubescent growth has ceased, in order to reduce the need for bone augmentation surgery since a long period of edentulousness is likely to lead to a reduction in alveolar bone height.

An understanding of the psychosocial status of the patient with ectodermal dysplasia is crucial since the unaesthetic appearance that accompanies the syndrome often has a negative psychological effect on the patient. Poor self-image, peer pressure and school- or job-related discrimination have been directly related to psychological scarring experienced by these patients. Early intervention is required to manage the orofacial disfigurement and to afford the patient some measure of confidence. The strategy is intended to help to minimize the onset of emotional and psychosocial problems for the patients and their families, but it depends critically on success in achieving the effective prevention of caries and periodontal disease.

What this case report adds

- This paper describes Witkop Tooth & Nail syndrome (Witkop TNS) in a child and her mother.
- The child showed short stature and facial features not previously described in TNS, as well as characteristic dental defects.

Why this paper is relevant to paediatric dentists

- Witkop TNS is rare but needs to be differentiated from other forms of disorder showing a similar pattern of dental defects.
- Dental defects seen in Witkop TNS are likely to require specialist treatment but affected patients also need effective preventive care.

Résumé. Le syndrome dent et ongle est une dysplasie ectodermique autosomique dominante caractérisée par des agénésies et des dysplasies des ongles. Des mutations en MSX-1 ont été identifiées dans le syndrome dent et ongle de Witkop. Les incisives et secondes molaires mandibulaires et les canines maxillaires sont les dents manquant le plus souvent. La forme des dents peut varier, les couronnes étroites et coniques étant fréquentes. La dysplasie des ongles affecte les ongles des doigts et des orteils et est souvent plus sévère pendant l'enfance. Les ongles peuvent être en forme de cuillères, rigides, de croissance lente et cassant facilement. Cet article décrit les caractéristiques cliniques et radiographiques chez une mère et son enfant présentant ce syndrome rare.

Zusammenfassung. Witkop Syndrom ist eine autosomal dominante ectodermale Dysplasie, die charakterisiert ist durch Hypodontie und Nageldysplasie. Mutationen im MSX-I Gen wurden bei Witkop Syndrom gezeigt. Unterkiefer-Schneidezähne, zweite Molaren und Oberkiefer Eckzähne sind die am häufigsten von Nichtanlage betroffenen Zähne.

Die Zahnform kann variieren, konische oder schmale Kronen sind häufig. Die Nageldysplasie betrifft Fingernägel, Zehennägel und ist im Kindesalter besonders stark ausgeprägt. Die Nägel können ghetüpfelt, brüchig, langsam wachsend und rigide sein. Die klinischen und röntgenologischen Befunde einer Mutter und Tochter, beide mit dem seltenen Syndrom, werden vorgestellt.

Resumen. El Síndrome del diente y uña es una displasia ectodérmica autosómica dominante caracterizada por hipodoncia y displasia de la uña. Se han identificado en el síndrome de diente y uña de Witkop, mutaciones en MSX – 1. Los incisivos inferiores, los segundos molares y los caninos superiores son los dientes que faltan con más frecuencia. La forma de los dientes puede variar, son frecuentes las formas cónicas y estrechas. La displasia de la uña afecta a las uñas de los dedos de las manos y pies y es a menudo más severo en la infancia. Las uñas pueden tener forma de cuchara, rígidas, de crecimiento lento, y frágiles. Se describen los signos clínicos y radiográficos del niño y la madre que se presentan con esta rara alteración.

References

1 Murdoch Kinch CA, Miles DA, Poon CK. Hypodontia and nail dysplasia syndrome: report of a case. *Oral Surgery, Oral Medicine and Oral Pathology* 1993; **75** (3): 403–406.

2 Witkop CJ, Tiecke RW Jr. Genetic diseases of the oral cavity. *Oral Pathology* 1965; **15**: 810–814.
3 Zabawski EJ Jr, Cohen JB. Hereditary hypodontia and onchorrhexis of the fingernails and toe nails Koilonychia. Witkop's tooth and nail syndrome. *Dermatology Journal* 1999; **5** (1): 3.
4 Giansanti JS, Long SM, Rankin JL. The tooth and nail type of autosomal dominant ectodermal dysplasia. *Oral Surgery* 1974; **37**: 576–382.
5 Hudson CD, Witkop CJ. Autosomal dominant hypodontia with nail dysgenesis. *Oral Surgery* 1975; **39**: 409–423.
6 Jumlongras D, Bei M, Stimson JM, *et al*. A nonsense mutation in MSX 1 causes Witkop's syndrome. *American Journal of Human Genetics* 2001; **69** (1): 67–74.
7 Hudson CD, Witkop CJ Jr. Autosomal dominant hypodontia with nail dysgenesis. *Oral Surgery* 1975; **39**: 409–423.
8 Thorton CM, Magee AC, Thomas PS, Feakins R, Nevin NC, O'Hara MD. Congenital heart disease and urinary tract abnormalities in two siblings with DOOR syndrome. *Pediatric Pathology* 1994; **14** (5): 797–803.
9 Cantwell RJ. Congenital sensori-neural deafness associated with onycho-osteo dystrophy and mental retardation (D.O.O.R. syndrome). *Human Genetics* 1975; **26** (3): 261–265.
10 Shairo SD, Jorgenson RJ, Salinas CF. Curry–Hall syndrome. *American Journal of Medical Genetics* 1984; **17** (3): 579–583.
11 Guckes AD, Braim JS, McCarthy GR, Ruby SF, Copper LF. Using endosseous dental implants for patients with ectodermal dysplasia. *Journal of American Dental Association* 1991; **122**: 59–62.
12 Pigno MA, Blackman RB, Cronin RJ Jr, Cavazos E. Prosthetic management of ectodermal dysplasia a review of the literature. *Journal of Prosthetic Dentistry* 1996; **76**: 541–545.