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Review

Assessment Genetics Mutations in Genes AMELX, ENAM, MMP20 and FAM83H in Inducate Amelogenesis Imperfecta Syndrome

Shahin Asadi*

Director of the Division of Medical Genetics and Molecular Research, Molecular Medicine, Genetics Harvard University, USA

Correspondence to: Shahin Asadi; Director of the Division of Medical Genetics and Molecular Research, Molecular Medicine, Genetics Harvard University, USA; E-mail: shahin.asadi1985@gmail.com

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ABSTRACT

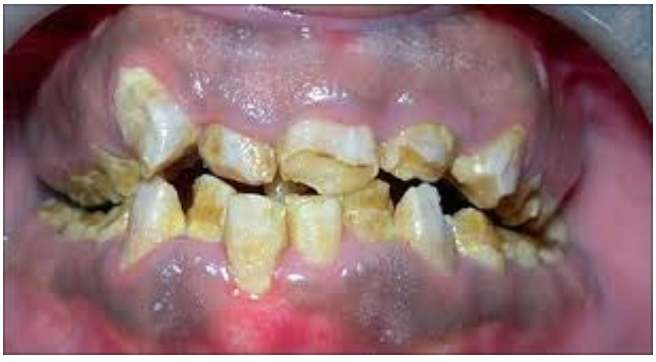
Defective amelogenesis syndrome is a genetic disorder in the development of teeth. The researchers described at least 14 types of incomplete amelogenesis disorders. Mutations in the AMELX, ENAM, MMP20, and FAM83H genes can cause malformation of the amelogenesis syndrome.

Keywords: *Amelogenesis syndrome, AMELX, ENAM, MMP20, FAM83H genes, Teeth disorders..*

GENERALIZATIONS OF INCOMPLETE AMELOGENESIS SYNDROME

Defective amelogenesis syndrome is a genetic disorder in the development of teeth. This condition causes the teeth to be abnormally small, colored, pitted or perforated, and are prone to wear and breakage. Other dental disorders may also occur in incomplete amelogenesis syndrome. These defects, which vary among people affected, can affect the teeth (the child) and permanent teeth (adults).[1]

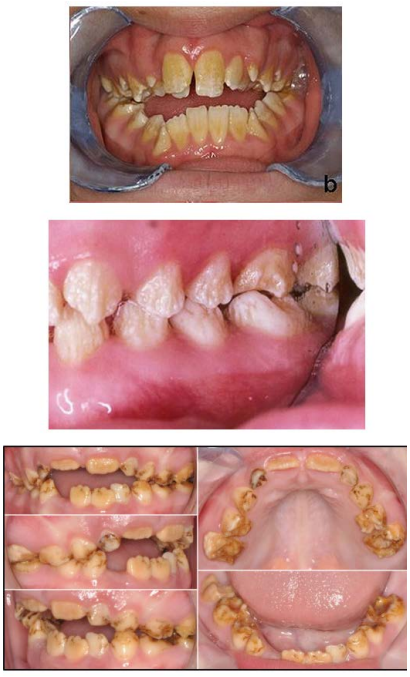
Figure 1. A picture of human teeth with amelogenesis syndrome associated with the related disorder



CLINICAL SIGNS AND SYMPTOMS OF INCOMPLETE AMELOGENIC SYNDROME

The researchers described at least 14 types of incomplete amelogenesis disorders. Types of disorders of this syndrome are characterized by specific dental disorders and hereditary patterns. Additionally, incomplete amelogenesis syndrome can occur alone without any other symptoms or symptoms, or it can occur as part of a syndrome that affects different parts of the body.[2]

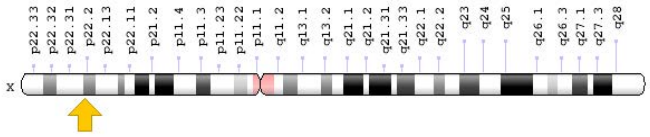
Figure 2. Another view of dental disorders in amelogenesis syndrome



ETIOLOGY OF INCOMPLETE AMELOGENESIS SYNDROME

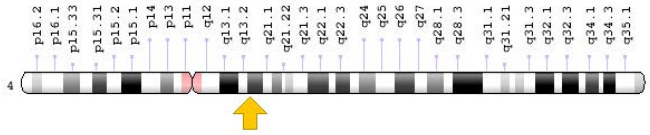
Mutations in the AMELX, ENAM, MMP20, and FAM83H genes can cause malformation of the amelogenesis syndrome. The AMELX gene is based on Xp22.2 in the short arm of the X chromosome. The ENAM gene is based on the long arm of chromosome 4 at 4q13.3. The MMP20 gene is based on the long arm of chromosome 11 as 11q22.2. The FAM83H gene is based on the long arm of chromosome 8 as 8q24.3.[3]

Figure 3. Schematic representation of the X chromosome X, whose AMELX gene is based on the chromosome's short arm as Xp22.2.



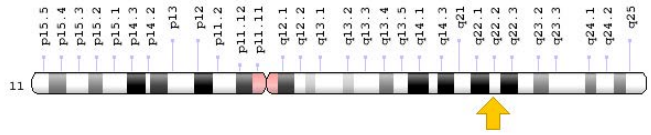
The AMELX, ENAM, and MMP20 genes provide instructions for the synthesis of proteins that are essential for the normal development of the teeth. Many of these teeth are involved in the formation of enamel, which is rich in calcium-rich materials, and the outer layer forms a protective tooth.[4]

Figure 4. Schematic view of chromosome number 4, where the ENAM gene is located in the long arm of this chromosome as 4q13.3.



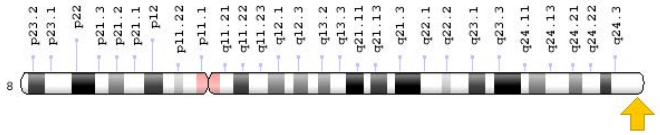
Although the function of the protein produced from the FAM83H gene is unknown, it is believed that FAM83H protein is involved in the formation of enamel. Mutations in either of these genes result in altered protein structures or preventing the production of relevant proteins. As a result, the tooth enamel will be abnormally thin or soft and may have a yellowish or brownish color. The teeth with imperfect enamel are weak and easily vulnerable.[5]

Figure 5. Schematic view of chromosome 11, in which the MMP20 gene is located in the long arm of this chromosome 11q22.2.



The mutations in the genes described in the text account for only about half of the cases and the mutation in the FAM83H gene causes most of these cases. In the remaining cases, the cause of genetics has not been identified. Researchers are looking for mutations in other genes that could be involved in the disorder.[6]

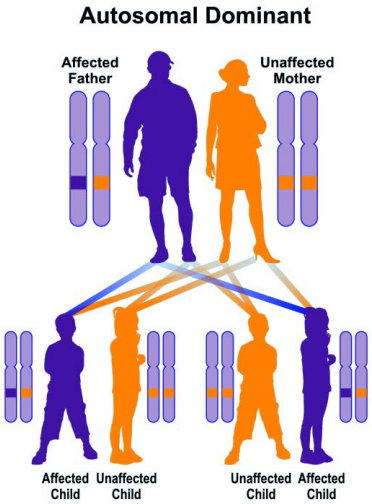
Figure 6. Schematic view of chromosome number 8, in which the FAM83H gene is located in the long arm of this chromosome 8q24.3.



Incomplete amelogenesis syndrome often occurs with mutations in the FAM83H gene and, in some cases, with the mutation in the ENAM gene, from the dominant autosomal inheritance pattern. Therefore, a gene mutation of FAM83H and ENAM (parent or parent) is required to produce this syndrome and the chance of having a child with this syndrome in the dominant autosomal state is 50% for each pregnancy.[7]

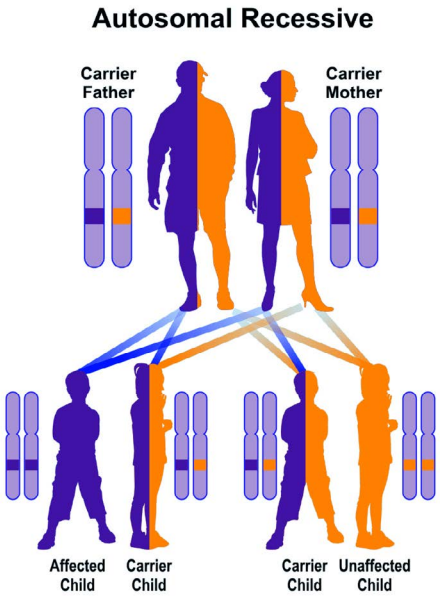
The incomplete amelogenesis syndrome, in cases of mutation in the MMP20 gene or ENAM, follows an autosomal recessive pattern of heredity. Therefore, in order to create this syndrome, two copies of the mutated genes MMP20 or ENAM (one parent and mother) are needed, and the chance of having a child with this syndrome in an autosomal recessive state can be 25% for each pregnancy.[8]

Figure 7. Schematic view of the dominant autosomal inheritance pattern that causes amelogenesis syndrome to follow this pattern with mutations in the FAM83H and ENAM genes.



Approximately 5% of cases of incomplete amelogenesis syndrome follow AMELX gene mutations in the X-linked hereditary pattern. The gene associated with this condition is located on the X chromosome sex chromosome, which is one of two sex chromosomes. In women (which have two chromosomes X), mutation in one of two gene variants in each cell may cause a disorder. In men (which have only one chromosome X), mutations in the single copy of the gene in each cell cause disruption. In most cases, X-related heritages experience more severe dental disorders than women. Characteristics of the X-dependent inheritance pattern are that fathers can not pass attributes associated with X to their son's sons. Other cases of incomplete amelogenesis syndrome are due to new mutations and no family history.[9]

Figure 8. Schematic view of an autosomal recessive hereditary pattern followed by incomplete amelogenesis syndrome by mutation in the MMP20 and ENAM genes of this pattern.



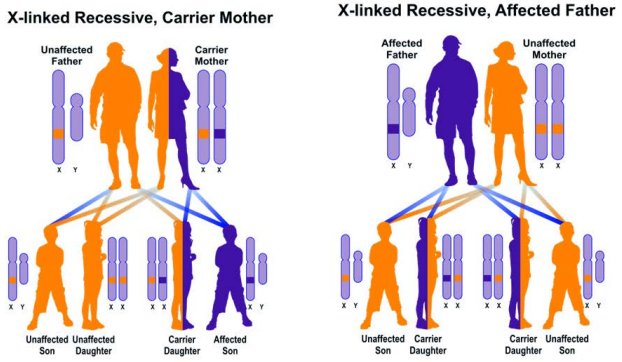
FREQUENCY OF INCOMPLETE AMELOGENESIS SYNDROME

Amelogenesis Syndrome is an incomplete genetic disorder whose frequency is not known in the world. The prevalence of this syndrome in northern Sweden is approximately 1 in 700, and in the United States it is estimated to be about 1 in 14,000.[10]

DIAGNOSIS OF INCOMPLETE AMELOGENESIS SYNDROME

Defective amelogenesis syndrome is diagnosed based on the clinical and physical findings of the patients and some dental examinations. The most accurate method for detecting this syndrome is the molecular genetic testing of AMELX, ENAM, MMP20, and FAM83H genes to investigate the presence of possible mutations.[11]

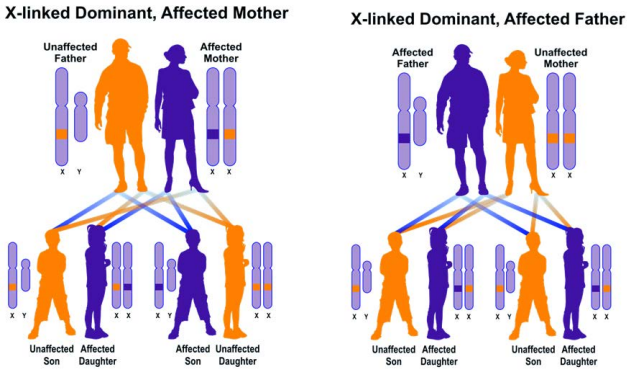
Figure 9. Schematic view of the X-recessive hereditary pattern, the mother of the vector (left) and the patient's father (right) whose incomplete amelogenesis syndrome with AMELX gene mutation can follow this pattern



THERAPEUTIC ROUTES OF INCOMPLETE AMELOGENESIS SYNDROME

The strategy of treatment and management of incomplete amelogenesis syndrome is symptomatic and supportive. Treatment may be done by a team of experts including dental practitioners, dental surgeons, jaw experts, and other healthcare professionals. There is no reliable treatment for this syndrome, and all clinical measures are designed to reduce the suffering of the sufferers. Genetic counseling is also a special place for all parents who want a healthy baby.[11]

Figure 10. A schematic view of the dominant X dominant hereditary pattern, the patient's mother (left), and the patient's father (right) whose incomplete amelogenesis syndrome can be obeyed by AMELX gene mutation



DISCUSSION AND CONCLUSION

Defective amelogenesis syndrome is a genetic disorder in the development of teeth. The researchers described at least 14 types of incomplete amelogenesis disorders. Mutations in the AMELX, ENAM, MMP20, and FAM83H genes can cause malformation of the amelogenesis syndrome. There is no reliable treatment for this syndrome, and all clinical measures are designed to reduce the suffering of the sufferers.

REFERENCES

1. Aldred MJ, Savarirayan R, Crawford PJ. Amelogenesis imperfecta: a classification and catalogue for the 21st century. Oral Dis. 2003; 9(1): 19-23.

2. Chan HC, Estrella NM, Milkovich RN, Kim JW, Simmer JP, Hu JC. Target gene analyses of 39 amelogenesis imperfecta kindreds. *Eur J Oral Sci*. 2011; 119(1): 311-323. doi: 10.1111/j.1600-0722.2011.00857.x

3. Gasse B, Karayigit E, Mathieu E, et al. Homozygous and compound heterozygous MMP20 mutations in amelogenesis imperfecta. *J Dent Res*. 2013; 92(7): 598-603. doi: 10.1177/0022034513488393

4. Hart TC, Hart PS, Gorry MC, et al. Novel ENAM mutation responsible for autosomal recessive amelogenesis imperfecta and localised enamel defects. *J Med Genet*. 2003; 40(12): 900-906.

5. Hu JC, Chan HC, Simmer SG, et al. Amelogenesis imperfecta in two families with defined AMELX deletions in ARHGAP6. *PLoS One*. 2012; 7(12): e52052. doi: 10.1371/journal.pone.0052052

6. Kim JW, Seymen F, Lin BP, Kiziltan B, Gencay K, Simmer JP, Hu JC. ENAM mutations in autosomal-dominant amelogenesis imperfecta. *J*

Dent Res. 2005; 84(3): 278-282. doi: 10.1177/154405910508400314

7. Kim JW, Simmer JP, Hu YY, et al. Amelogenin p.M1T and p.W4S mutations underlying hypoplastic X-linked amelogenesis imperfecta. *J Dent Res*. 2004; 83(5): 378-383. doi: 10.1177/154405910408300505

8. Lee SK, Lee KE, Jeong TS, et al. FAM83H mutations cause ADHCAI and alter intracellular protein localization. *J Dent Res*. 2011; 90(3): 377-381. doi: 10.1177/0022034510389177

9. Nusier M, Yassin O, Hart TC, Samimi A, Wright JT. Phenotypic diversity and revision of the nomenclature for autosomal recessive amelogenesis imperfecta. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2004; 97(2): 220-230. doi: 10.1016/S1079210403005031

10. Wright JT, Torain M, Long K, et al. Amelogenesis imperfecta: genotype-phenotype studies in 71 families. *Cells Tissues Organs*. 2011; 194(2-4): 279-283. doi: 10.1159/000324339

11. Wright JT. The molecular etiologies and associated phenotypes of amelogenesis imperfecta. *Am J Med Genet A*. 2006; 140(23): 2547-2555. doi: 10.1002%2Fajmg.a.31358