

# Teeth: Common Concerns



# Teeth: common concerns

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Unique publishes a separate guide: **Looking after your child's teeth**

Unique acknowledges that this guide cannot be comprehensive. We welcome new information on the impact of rare chromosome disorders on teeth. Please email Unique at [info@rarechromo.org](mailto:info@rarechromo.org) or Prisca Middlemiss @ [prisca@rarechromo.org](mailto:prisca@rarechromo.org)

## What are teeth made of?

Teeth are made of three layers of hard material found nowhere else in the body.

**Enamel** is the hard covering.

**Dentine** is the slightly elastic tissue that forms most of the tooth. In the US, it's dentin.

**Pulp** is the material beneath the dentine where the blood vessels and nerves are.

**Cementum** is a thin layer of hard tissue covering the root.

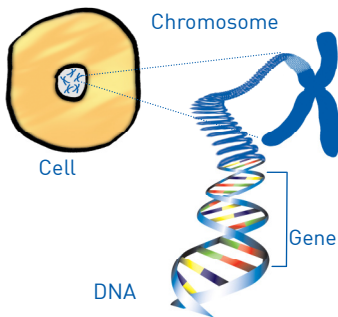
**Cusps** and **fissures** are pointed projections and grooves on the biting surface.

## How do teeth develop?

The development of teeth and the face is controlled by many different genes.

Acting together in a very complex way, genes programme the pattern of the teeth in the top and bottom jaws, their shape, and the way they develop. Anything that disrupts the smooth functioning of these genes can cause a dental problem.

So dental problems are very common – both among people without chromosome disorders and people with them. In children with chromosome disorders, there is quite often more than one dental problem.



## What are genes?

Genes are the basic units of heredity. They act as instructions to make molecules called proteins. Humans have about 20,000 genes in their chromosomes.

## Words

Dentists sometimes use technical words. Sometimes other words mean the same thing.

|                      |  |
|----------------------|--|
| <b>First teeth</b>   | Baby teeth Milk teeth Primary teeth Temporary teeth<br>Deciduous |
| <b>Adult teeth</b>   | Permanent teeth Big teeth Secondary teeth Second teeth           |
| <b>Erupt</b>         | Appear Emerge Break through Come through                         |
| <b>Fall out</b>      | Lose Shed Exfoliate  |
| <b>Front tooth</b>   | Incisor Incisors can be central (middle) or lateral (side)       |
| <b>Back tooth</b>    | Molar  |
| <b>Wisdom tooth</b>  | Third molar  |
| <b>Top</b>           | Maxillary Upper  |
| <b>Bottom</b>        | Mandibular Lower   |
| <b>Contralateral</b> | The tooth in the same position on the other side of the mouth    |

## Teething

A baby's first teeth start to form at around week 6 in pregnancy.

Around 4 months into pregnancy the first teeth start to absorb calcium.

Adult teeth start to form during pregnancy, at around week 20.

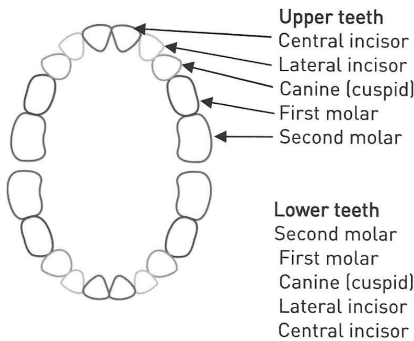
The adult teeth start to absorb calcium when a baby is around 4 months old.

Teeth usually appear in the same order and around the same age. Generally, bottom teeth come through before top teeth, and girls' teeth come through earlier than boys'.

We usually have 20 first teeth. First teeth usually start to appear between 4-6 months and one year. The last of the first teeth to come through are usually the back (second) molars, which generally appear by 2½ to 3 years, although it can be later.

| Come through | Lose        |
|--------------|-------------|
| 8-12 months  | 6-7 years   |
| 9-13 months  | 7-8 years   |
| 16-22 months | 10-12 years |
| 13-19 months | 9-11 years  |
| 25-33 months | 10-12 years |

| Come through | Lose        |
|--------------|-------------|
| 23-31 months | 10-12 years |
| 14-18 months | 9-11 years  |
| 17-23 months | 9-12 years  |
| 10-16 months | 7-8 years   |
| 6-10 months  | 6-7 years   |



A 'typical' teething chart. In children with chromosome disorders, teeth can come through early or late, and in an unusual order. There is quite often more than one dental problem.

We usually have 32 adult teeth. Adult teeth usually come through between 6-7 years (bottom front teeth) and 13 years (back molars). Third molars (wisdom teeth) usually come through between 17-21 years, if they appear at all.

In children with chromosome disorders, teeth can erupt in a different order.

Pain pathways are late to develop in some children with a chromosome disorder, so they may show no discomfort when teething.

## Early teething

Some babies are born with visible teeth, or they come through in the first month. They usually have very shallow roots or no roots at all. If the tooth is loose or gets in the way of feeding, it needs to be removed to prevent a baby swallowing it. Natal and neonatal teeth are usually a baby's normal first teeth.



Natal teeth



## Words

**Natal teeth** Teeth visible at birth

**Neonatal teeth** Teeth that come through in the first month of life

**Pre-erupted teeth** Teeth that appear within months 2 and 3

Any baby can have natal or neonatal teeth. They are found in around 1 baby in every 2-3,000. We don't know if they are more common in babies with a chromosome disorder. Within Unique, babies with the following disorders have been reported with one or more natal or neonatal teeth: 1q24 duplication; 1p36.3 deletion; 1q43 deletion; large interstitial deletion of 7p; 6q27 duplication; large interstitial deletion starting at 8q11.21; inverted duplication with deletion of 8p; 9q34.3 deletion (Kleefstra syndrome); 10q25q26 deletion; marker chromosome 15; 16p13p12 duplication; 22q13.31 deletion (Phelan-McDermid syndrome); unbalanced translocation between Xp and 3q12.

It's more common for teeth to appear from 2 months onwards. Most often, one or both of the bottom front teeth erupt early. Their development is usually correct for the age of the baby, so the enamel is not yet completely formed. This may be because the tooth has developed very superficially under the gum rather than within the jaw bone.

Early first teeth do not in themselves pose a problem, but parents need to bring forward their baby's first visit to the dentist. Sometimes just one or two teeth erupt early, but within Unique it is more common for a baby to get all their first teeth early. At Unique it is not unusual for a baby to have all their first teeth before their first birthday. The teeth may look perfectly normal, or they may have an odd shape, or be unusually small or large. Sometimes the enamel surface of the tooth is thin, chalky or pitted.

When the first teeth come through early, they may fall out early, and the adult teeth may also come through early, but this does not always happen.

Within Unique, babies with the following disorders have had early teething:

*2-3 months (prematurely erupted teeth)*

8p23 deletion; trisomy 8 mosaicism; 15q deletion; 15q duplication; 22q13.3 deletion (Phelan-McDermid syndrome).

*4-5 months*

16p12 deletion; 10p deletion with Yq duplication.

*Not specified*

2p15p16.1 deletion; 2p16.3 deletion; 2p24 deletion; 3q21 duplication; 3q29 duplication; 4q35.1 deletion; 4; 8 translocation; 5q32 deletion; 6q15 deletion; 6q24 duplication; trisomy 8 mosaicism; 16p12 deletion; 17p11.2 duplication (Potocki-Lupski syndrome); 22q13.3 deletion (Phelan-McDermid syndrome); 45X/46XY.

## Early adult teeth

Adult teeth that come through early can follow early loss of first teeth. Children with hormone disorders such as too much growth hormone or too much thyroid hormone (hyperthyroidism) can get their adult teeth early.

Among Unique members, adult teeth can start coming through from 4 years.

Within Unique, children with the following disorders have had early adult teeth: 1q21.1 deletion; 3q13 deletion; 4p duplication; 6p25 deletion; 9p22 deletion; 10q26 deletion; recombinant 15.

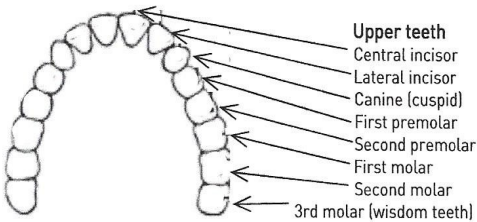
## One family's experience

"Her first tooth erupted when she was 6 weeks old, and she had all her first teeth through by 10 months. She then lost her first teeth from about the age of 4 over a normal period of time, but her second teeth didn't start to come through for about 9 months after losing her first front teeth."

## Adult teeth: 'typical' sequence

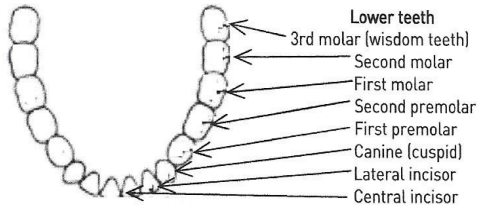
### Come through

- 7-8 years
- 8-9 years
- 11-12 years
- 10-11 years
- 10-12 years
- 6-7 years
- 12-13 years
- 17-21 years



### Come through

- 17-21 years
- 11-13 years
- 6-7 years
- 11-12 years
- 10-12 years
- 9-10 years
- 7-8 years
- 6-7 years



First adult tooth coming through slightly early at 5½ years



All adult teeth by 10 years

## Late teething

It is perfectly normal for first teeth to come through between 6 and 12 months. It's known that children with low thyroid levels, children with hypopituitarism (low levels of one or more of the 8 hormones produced by the pituitary gland), and children with Down's syndrome have teeth that come through late. It is Unique's experience that teeth come through late in children with other chromosome disorders. Four times as many families tell us that their child's teeth came through late as came through early. In most late-teething children, first teeth were seen between 12 and 18 months, and most often between 12 and 15 months. Very occasionally, first teeth erupted after the age of 2, and these are noted in the disorder list that follows. In many cases but certainly not all, late teething was not the only dental issue: unusual sequence; missing teeth; crowding; crooked teeth and abnormally shaped teeth were some of the other dental concerns.

There is nothing that you can do to stimulate teeth to come through early, and there can be advantages: if you are breast feeding, you are less likely to be painfully bitten. However, a baby or toddler without teeth is less likely to chew well. Even if your child has no teeth, they should still see a dentist by their first birthday. If your baby has no teeth by 18 months, you should certainly see a dentist, who may refer your child for a specialist opinion.

Unique has records of late teething with these diagnoses, starting with the most common: an extra X chromosome, especially 48,XXXX (tetrasomy X) and 49,XXXXY; 15q26 deletions; 1q32q42 duplication; 4q12q21 deletion (in one child, 2 years); 9p duplications; 10q26 deletions; Pallister-Killian syndrome; 19p13.13 microdeletion syndrome; 2q37 deletion; 1q21.1 microdeletion; 1q24 deletion; 2q24 deletion; 2q11q21 duplication; ring 2; 3p25 deletion; 3q27q29 deletion; 44p duplication; q21 deletion; 4q28 deletion; 4q25q31 duplication; 5p15.3 deletion; 5q14.3q15 deletion; 5q15q22 deletion; 6p25p24 duplication; 6q14q15 duplication; 6q25.3 duplication; 7q11.22 microdeletion; 7q31q32 deletion; 7q36.2 deletion; 7q11.23 duplication; 7q36.1 duplication; 8p12 interstitial deletion; 8p23 duplication; 9q22q31 deletion; 9q32q34.1 deletion; Kleeftstra syndrome (9q34.3 deletion); ring 9; 10q23.2 deletion; 11p15.4 deletion; 12q14.3q14 deletion; 13q12 interstitial deletion; 14q13q21 deletion; 15q24.1q24.2 deletion; idic 15; 16p13.11 microdeletion; 16p11.2 microduplication; 17p13.3 deletion; Koolen-de Vries syndrome (17q21.31 deletion); 19q13.4 microdeletion; 22q11.2 deletion; Emanuel syndrome (partial trisomy 22); Xp11.23p11.22 duplication; an extra Y chromosome. In addition, late teething was seen in children with a variety of dual imbalances, usually involving a loss of DNA from one chromosome and extra DNA on another. The X chromosome was involved in 38 per cent of these cases. In one child with loss of DNA from Xp22.3, first teeth erupted at 2 years.

It is more unusual for families to tell Unique that adult teeth erupted late. Families with these disorders have had that experience: 1p31p22 deletion; 7q22q31 deletion. However, many families say that their child's first teeth are delayed in falling out. When the first teeth are late to fall out, the adult teeth are often late to erupt.

## Unusual sequence

In typically developing babies the teeth erupt in a well known order, very roughly starting at the bottom and working from the middle to the back. This order is disrupted in some babies with chromosome disorders. Unique records show that when tooth sequence is disrupted it is very common to have other dental concerns as well, especially late teething and missing teeth.

There is nothing that you as a parent can do to change this, but it can help to be aware that back teeth can come through while front teeth are still missing. Some babies are upset while their back teeth are coming through, and need to bite or gnaw to help their discomfort.

Unique's records show that teeth erupted in an unusual sequence in babies with these chromosome disorders: 2q33.1 deletion; 3q26.33 deletion; 3q29 deletion; 5q13.33 duplication; 6q25.3 duplication; 8q23.1 interstitial duplication; 9q33.3q34.11 deletion; an extra ring chromosome 9; 10q26 deletion; 12p duplication; 15q26 deletion; 22q11.2 deletion; Phelan-McDermid syndrome (22q13.3 deletion).

## Missing teeth

### Words

**Missing teeth** Hypodontia This is severe if more than 6 teeth are missing, excluding wisdom teeth (3<sup>rd</sup> molars)

**Oligodontia** More than 6 teeth missing, excluding wisdom teeth (3<sup>rd</sup> molars)

**Anodontia** Total failure of first or adult teeth to develop No teeth at all

**Tooth that doesn't come through** Unerupted tooth

**Resorption** Dissolving of part of the tooth within the bone – usually the root.

Tooth erupts but then gets submerged in the gum Infraocclusion Submerged Ankylosed



There is a close link between missing teeth, very small teeth and unusually formed teeth, especially cone-shaped teeth.

When a tooth does not appear, you won't know at first why: is it in the jawbone but invisible, or is it really missing? A dental X-ray will give the answer, if this is possible and justifiable. If an X-ray shows an embryonic tooth, but a tooth does not come through, it may be because it is in the wrong position or there is not enough room in the jaw. The developing tooth becomes impacted. It may be possible with surgery to free enough space for the tooth to come through. If it is not possible to remove other teeth to allow the impacted tooth through, it will often stay within the jaws without causing problems, but may damage or resorb the roots of neighbouring teeth.

Sometimes a tooth erupts, but then gets submerged in the gum. This is most common in children who take particular medicines to control their epilepsy: one of the effects of some anti epilepsy drugs is to make the gums enlarge [see [Looking after your child's teeth Medicines](#) ].

Having some missing adult teeth is not as unusual as you may think. Between one person in 12 and 1 in 30 has one or more missing adult teeth. If you include wisdom teeth (third molars), it's even more common: more than 1 person in 5 has missing wisdom teeth. But missing teeth are probably more common in people with chromosome disorders. The teeth that usually fail to appear are the bottom second premolars and the top lateral incisors [see [Diagram, page 5](#)]. When just one top lateral incisor is missing, the other can be peg-shaped or conical.

It's not so common to be missing 6 or more teeth (severe hypodontia). This affects about 1 person in 400. Having no teeth at all (anodontia) is really very rare, and we have not seen this at Unique.

Missing first teeth is less common. Less than 1 baby in 100 is missing any of the 20 first teeth. You'll know by 3-4 years old if the tooth is really missing. Usually if the baby tooth is missing, the adult tooth will also be missing.



Missing teeth is linked with many syndromes, including chromosome disorders. Sometimes there is a pattern to the missing teeth. Opposite pairs of teeth, or groups of teeth are missing. More often it's haphazard.

The cause of missing teeth is usually genetic, although the environment can have an influence. How common it is varies around the world, and it is more common among females than males.

There is a close link between missing teeth, very small teeth and unusually formed teeth, especially cone-shaped teeth – all can be caused by disruption in the same genes. Among those with an extra X chromosome, some of the other teeth may be very large.

Among children with chromosome disorders the impact of missing teeth on feeding and chewing needs to be assessed in the context of any low muscle tone in the face and mouth, and any impact on speech and language development.

Gaps caused by missing adult teeth can be filled either by using braces to reposition teeth, by transplanting a tooth from an overcrowded part of the mouth, or by using a dental implant, or even false teeth. Among children with

chromosome disorders, the benefits are balanced against any stress the child feels about dental visits, and their ability to cope with interventions in their mouth.



**A lovely smile**

Spaces in the smile can be disguised by a variety of techniques, but is often best planned by a specialist dental team rather than a family dentist. It should be remembered that although the teeth happen to be in the middle of a smile, we smile with our whole face, eyes included. Perfect teeth are not essential for a lovely smile. Total anodontia can be very difficult to manage, particularly if there is any developmental delay which makes coping with full dentures difficult.

Unique's records show that missing

teeth were especially common among young men and women with extra X chromosomes, and to a lesser extent among young men with extra Y chromosomes. Those with 48,XXYY were most likely to report missing teeth. Missing teeth were also seen repeatedly in people with Koolen-de Vries syndrome and 1q32q42 duplications, 2q37 deletions, 3q27 deletions, 4p duplications and 7q11.22 deletions (one top front tooth). Missing teeth were also seen in people with these disorders: 1q42q43 deletion; 1q44 deletion; 2q12 interstitial duplication; 3p25 deletion; Wolf-Hirschhorn syndrome (8 teeth

missing); 4q31 deletion; 4p15.1 duplication; 6p25p22 duplication; 7q34 deletion; 7q36 deletion; 8p21 deletion; trisomy 8 mosaicism; Alfi's syndrome (9p22 deletion); Kleefstra syndrome (9q34 deletion); trisomy 9p; 13q32q34 deletion; 14q11.2q13.1 duplication; 15q13.2q13.2 deletion; 15q26.1 deletion; 15q13q21 duplication; idic 15; 16p11.2 microdeletion; 16q11.2q12 deletion; 17p13.3 deletion; 17p12 duplication; 17p13.1 microduplication; 18p deletion. In addition, missing teeth were seen in children with a variety of dual imbalances involving a loss of DNA from one chromosome and extra DNA on another: chromosomes 4 and 8; 5 and 9; and 13 and 18 were involved.

## Extra teeth

### Words

**Extra teeth** Supernumerary teeth Supplemental teeth Hyperdontia Many extra teeth

**Mesiodens** Extra top front tooth

**Paramolar** Extra top molar usually on the cheek side of the gum, rather than the mouth side

It's not uncommon to have an extra tooth. At least 1 to 3 people in every 100 have an extra adult tooth. An extra first tooth is not so common. Extra adult teeth are more common in men than women. Extra teeth are more common in people with a cleft palate. Generally speaking, more than 90 per cent of extra teeth are in the upper jaw, and most commonly in the midline of the upper jaw.



A small extra tooth in the middle of the top jaw

Extra teeth can be shaped like the teeth they are next to, but usually have an abnormal shape.

Sometimes they erupt fused with the neighbouring tooth.

The cause of extra teeth is still not understood. Genes are known to play an important role. Among other theories, one is that when the tooth bud forms at 6 weeks of pregnancy, it splits in two, creating two teeth; another is that extra teeth are evolutionary throw-backs, revealing teeth that were seen in our ancestors but have disappeared in modern man.

Sometimes the extra teeth are found in the jaws when your child has a dental X-ray. Usually they are first noticed when they erupt as an unusually-shaped tooth, or when their presence delays the eruption of an adult tooth. If an upper central incisor fails to erupt within 6 months of its partner, X-ray investigation is recommended. Depending on the position, and the effect the extra teeth have on the other teeth, they may require extraction or be left alone.

Unique's records show that extra teeth were especially common among young men and women with trisomy 8 mosaicism and other duplications of the short arm of chromosome 8; in people with 7q33 deletion (or duplication); and in people with 15q26 deletion. They were also found in people with 1q42.2

duplication; 2p15p16.1 deletion; 3q duplication; 4p duplication; 4q27q31 deletion; 6q27 duplication; 7q11q21 duplication; 9p deletion; trisomy 9 mosaicism; 10q25q26 duplication; 15q11.2 microdeletion; 16p proximal deletion; 22q11.2 duplication; and dual imbalances involving a loss of DNA from one chromosome and extra DNA on another: chromosomes 4 and 8; 4 and 10; 8 and 15; and 19 and 22 were involved.

## Widely spaced teeth

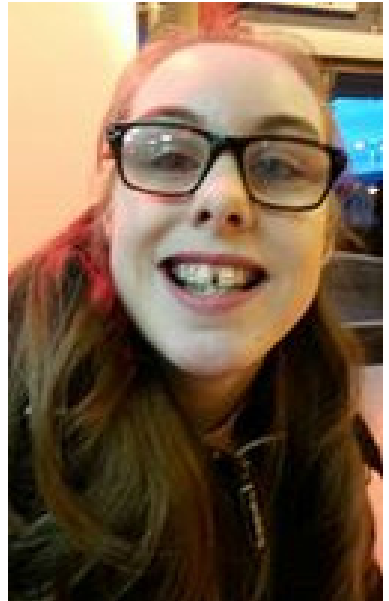
### Word

**Diastema** Gap between the top front teeth

Gaps between teeth are common, especially if your child has small teeth in a normal-sized jaw. If there is poor lip muscle tone or an unusual tongue-thrust on swallowing, the gaps may be due to the front teeth being splayed outwards. It may be possible to close spaced front teeth with orthodontic treatment, but many specialist orthodontists would prefer to leave mildly spaced teeth, as they are easier to brush than crowded or rotated teeth.

Unique's records show that widely spaced teeth were especially common among young men and women with Kleefstra syndrome (9q34 deletions); Koolen-de Vries syndrome (17q21.31 deletions); 21q22 deletions; and 1q21.1 microduplications. They also occurred in people with 1p36 deletion; 2q24.2 deletion; 2q37.3 deletion; 2q31q35 duplication; 3q27 deletion; 4p16p15 duplication; 5p15 duplication; 5q15q22 deletion; 7q11.22 deletion; 7q11.23 duplication; 7q22q31 deletion; 7q31q34 duplication; 7q32 deletion; inverted duplication with deletion of 8p; 9p22 deletion; ring 9; trisomy 9p; 10q26 deletion; 11q23 triplication; inverted duplication of 12p; 16p terminal deletion; 16q22q24 deletion; 17p13 duplication; duplication of Xp11.23; duplication of Xq28; an extra Y chromosome; and dual imbalances involving a loss of DNA from one chromosome and extra DNA on another: chromosomes 2 and 9; 4 and 8; 8 and 12; X and 16 were involved.

A midline diastema is common whether you have a chromosome condition or not, and either self corrects in time, or can be improved if this is considered necessary. Among Unique families it



has been recorded in young men and women with 1q21.1 microdeletion; 2p16.3 deletion; 4q21 deletion; 6q13q16 deletion; idic 15; 16p terminal deletion; tetrasomy X; and dual imbalances involving extra DNA on chromosomes 6q24.1 and Xp22.31.

### First teeth don't fall out

One of the most common dental concerns faced by Unique families is the failure of one or more first teeth to fall out. Young adults frequently still have some first teeth in place.

First teeth usually fall out when the adult tooth dissolves its root from beneath, causing the first tooth to become mobile and eventually exfoliate. If this process is delayed, the tooth will not fall out, delaying or deflecting the eruption of the adult teeth. Sometimes the adult teeth erupt in front or behind the first teeth so the child appears to have two sets. If no adult teeth have erupted by the expected age, the dentist can X-ray the jaws to see whether they are present but unerupted. They may then recommend removing the retained first teeth – either with local anaesthetic injections or under a general anaesthetic in hospital.

Unique's records show that first teeth that failed to fall out were especially common among young men and women with extra DNA on chromosome 8 (trisomy 8 mosaicism, supernumerary chromosome 8, inverted duplication with deletion of chromosome 8); duplications of 9p (isochromosome 9p and trisomy 9p) and Kleeftstra syndrome (9q34.3 deletion).

They also occurred in people with 1q41 deletion; 2p16.1p15 deletion; 2q23 deletion; 2q24 deletion; 2q33 deletion; ring 2; 2p13p21 duplication; 2q37.3 duplication; 3p21p14 deletion; 3p25 deletion; 3q26q27 deletion; 3q26 terminal deletion; 5p15 deletion; 5q Interstitial deletion; 5q35 duplication; an extra small chromosome 5; 5p15 duplication; 6p25 deletion; 6q16q22 deletion; 6q25q26 deletion; 6q24q26 duplication; 7q22 deletion; 7q31q33 deletion; 10p duplication; 10q23 deletion; 10q25 deletion; 10q26 deletion; 10q11q22 duplication; 12p terminal duplication; 12p13 deletion; 15q26 terminal deletion; idic 15; 15q13q21 duplication; 16p12 deletion; 16p duplication; 18p11 deletion; 18q deletion syndrome; 19q13 microdeletion; 21q11q22 deletion; 22q13 deletion (Phelan-McDermid syndrome); Emanuel syndrome; one or more extra Y chromosomes; duplication of Yq; 48, XYY; 49, XXXY; and dual imbalances involving a loss of DNA from one chromosome and extra DNA on another: chromosomes 1 and 5; 3 and 8; 4 and 14; 10 and 22; and X and 11 were involved.



First teeth still present



Retained lower baby incisors, giving the appearance of a double row of teeth, and causing severe crowding

## First teeth fall out early

Early exfoliation of first teeth is rare among Unique children and does not typically cause any problems. When the tooth comes out, your child may swallow it, but this does not cause any problems. Unique's records show that children with the following disorders started to shed their first teeth before the typical age of 6 years: 1q42q43 deletion; 3q13q21 deletion; 4p16p15 duplication; 6q14 duplication; 22q13 deletion (Phelan-McDermid syndrome); 10q deletion with Yp duplication.

## Cleft lip and/or palate

During early pregnancy different parts of the face develop separately and then join together. When some parts do not join properly, the result can be a cleft. A split in either the upper lip, the roof of the mouth or both is one of the most common birth anomalies, and can occur in association with more than 300 different syndromes, as well as chromosome disorders that are not part of a syndrome. At least 20 genes are known to be associated with clefts, and there may be more.



A repaired cleft palate

Many tooth disorders can occur with a cleft palate and/ or lip. The more severe the cleft, the more teeth are likely to be affected. At the front of the top jaw, there can be missing teeth, extra teeth, the teeth may be too big or too small; or there may be gaps. Gaps may occur between the canine (eye tooth) and the lateral incisor.

Sometimes the incisor is missing altogether. Or there may be 2 lateral incisors, one on each side of the cleft. Occasionally the middle front teeth may be affected in the same way as the

lateral incisor. Teeth in the area of the cleft may be displaced, so they come through in unexpected positions. Teeth may erupt very late or early. If teeth are missing, most commonly it's the upper lateral incisors. The teeth may be impacted (blocked) and not come through by themselves. An extra lateral incisor in first teeth is very common in toddlers with a cleft.

Some disorders that are known to disrupt the middle of the face, such as 18p deletions, can also have effects such as malocclusion (see below), leaving a gap between top and bottom teeth at the front.

Sometimes the enamel of the teeth in the cleft area is not properly formed, and those teeth may be prone to decay. The shape of the tooth in the cleft area may be different. Adult teeth may have more irregularities. Both the crown and the root of the incisor or other teeth may be irregularly shaped.

The palate is often narrow and the teeth are relatively large and crowded, so it's hard to keep them clean, and free of decay, and for the dentist to get access. Children with a cleft need the same dental care as other children but they also need early evaluation by a dentist familiar with clefts. This is usually arranged through a cleft team or craniofacial treatment centre. Orthodontic evaluation can be before the child has any teeth, to assess facial growth, especially the growth of the jaws. If any surgery is needed, dental and other surgery is usually scheduled to coincide so the child has no more surgical operations than necessary.

Unique's records show that midline dental problems were especially common among young men and women with an 18p deletion (single front tooth). They also occurred in people with a 2q duplication; 3q27 duplication; 4p duplication; 9q21 microdeletion; duplication 17p12; 18q22 deletion; and a 7; 12 unbalanced translocation.

## Malocclusion Incorrect alignment between jaws

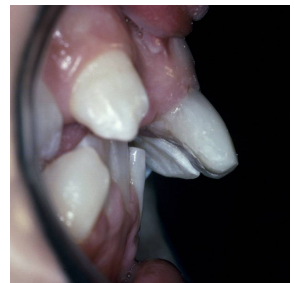
### Words

|                     |  |
|---------------------|--|
| <b>Malocclusion</b> | Abnormal bite                                      |
| <b>Overjet</b>      | Protruding upper teeth                             |
| <b>Overbite</b>     | Teeth overlap too much                             |
| <b>Crossbite</b>    | Reversed bite                                      |
| <b>Scissor bite</b> | Molar teeth miss each other completely when biting |

In an ideal world the teeth of the upper jaw would fit perfectly with the teeth of the bottom jaw when the mouth is closed. Dentists call this perfect occlusion. Very few people have perfect occlusion, but most occlusion abnormalities are so minor that they don't need treatment. Any obvious variation from the perfect fit is called malocclusion, and this includes significant overbite, open bite and crossbite. A significant malocclusion may cause problems with chewing, but rarely affects speech. Very marked malocclusion can mean that a child cannot chew at all. Sometimes the degree of mismatch is not clear until the child goes into puberty and their face takes on its adult shape.

Overjet means there is a horizontal discrepancy between the teeth. This may be due to habit e.g. thumb sucking or may be due to a skeletal abnormality such as retrognathia where the bottom jaw is too small.

If the problem is due to a small-sized lower jaw it is termed retrognathia, such as occurs in the Pierre Robin sequence. When the lower jaw is too short, the upper incisor teeth can appear to protrude, and may not be covered by the lips at rest.



Increased overjet, seen from the side



Crossbite: top tooth trapped behind bottom tooth

A crossbite of the front teeth is when one or more of the upper incisors are trapped behind the lower incisors. If severe, this can cause damage to the teeth or supporting gum tissue. A crossbite of the molar teeth at the back of the mouth may be because the top jaw is too narrow. This sometimes is a result of persistent mouth-breathing, particularly if the back of the nasal passages are chronically blocked by large adenoids.

An open bite is where the teeth do not meet, usually at the front, and can have several causes. Careful assessment of lip muscle function and tone should be made, including what happens with the lips and tongue during swallowing. Discussion with a specialist speech and language therapist will be helpful. A persistent “tongue thrust” swallowing pattern can also cause an open bite. Sometimes the shape of the jaws will make it impossible for the teeth to meet, and this is called a “skeletal open bite”.



Open bite:  
the teeth do not meet.

Treatment depends on your child, how far apart the teeth are, how much treatment your child can tolerate, whether the mismatch is expected to get worse, and your opinions and wishes. The gentlest treatment is the use of removable braces (commonly but incorrectly termed ‘retainers’), but these are only able to correct the mildest malocclusion. Modern orthodontic treatment usually involves fixed braces (‘train-track’ braces) which are provided by specialist orthodontists. It is very difficult to find an orthodontist brave enough to offer fixed-appliance treatment for a child with challenging behaviour, and this is understandable in view of the co-operation, motivation and multiple visits involved. Referral to hospital-based orthodontic services may be the most successful route to treatment if it is possible.

Tooth extractions, surgical exposure or removal of unerupted teeth, bonding chains or even corrective jaw surgery are all features of advanced treatment of a malocclusion. The more invasive the treatment options, the more the need or desire for treatment should be examined.

Treatment can sometimes start early, then rest for observation and monitoring, followed by more treatment when the adult teeth erupt.

Unique’s records show that overbite was especially common among boys with an extra X chromosome, and among boys and girls with a 5p15 duplication, 7q22q31 deletion; a 12q14 deletion, or a 17p11.2 duplication. Overbite also occurred in people with a 1q41 deletion; ring 1; 2q11.2 deletion; 3q terminal deletion; 3q26 terminal duplication; 4p duplication; 4q25q28 deletion; 4q31 terminal deletion; 4q32q34 deletion; 4p16p15 duplication; 5p15 duplication; 8p23 deletion; trisomy 8 mosaicism; 9q32q34 duplication; ring 10; 11q23 triplication;

ring 13; 15q13 deletion; 15q24 deletion; 15q25 deletion; 15q26 deletion; 15q11q14 duplication; idic 15; 16p13.3 duplication; 17p13.3 deletion; Koolen-deVries syndrome (17q21.31 deletion); 17p11.2 duplication; a 20p12 microdeletion; ring 21; 22q11.2 deletion; Phelan-McDermid syndrome (22q13 deletion); supernumerary ring 22; and a Y; 10 chromosome imbalance.

Unique's records show no association between underbite and any particular chromosome variation. Underbite occurred in people with a 1q21.1 microdeletion; 2q11q21 duplication; 7q11.23 duplication; 8p23 deletion; 10q23 deletion; Koolen-de Vries syndrome (17q21.31 deletion); an extra Y chromosome; and imbalances of 3 and 7; 4 and 8; 7 and 17; and 12 and 13.

"With new technology distractors were placed in his gums with a bit either side of a fracture, and the fracture was re-fractured daily with these devices causing 30 seconds of pain which by the old method of breaking and rewiring would have been much more painful. The jaw lengthening is now finished. Now we are correcting the bite and had what they called ramal hooks in at the back of his mouth so if the orthodontist needed to he could use these somehow to manipulate the jaw to help with teeth placement. His teeth have moved without needing these hooks and so they were removed last week, stitches out next week and he is looking much better in the shape of his face. However anxiety causes him to scratch at his face, so the skin is not so good."

Some Unique families record malocclusion, but do not specify what sort. Among these are children with a 2q37 deletion; a small extra chromosome 2; 15q11q14 duplication; 17p13.3 duplication; 21q11q22 deletion; 22q11.2 duplication; an extra chromosome 22; extra X chromosomes; and a mixed picture of microdeletions and microduplications.

## Crooked teeth

Crooked teeth are the most common single dental concern voiced by Unique members. The crowding, rotation or misalignment of teeth are all particular types of malocclusion and thus treatment is usually provided by a specialist orthodontist. Your child's general dentist will assess the position of the affected tooth or teeth, and advise on treatment and the options for referral.

Unique's records show that crooked teeth were especially common among children with 18p deletions or ring 18; trisomy 8 mosaicism or 8p duplications; 17p13 duplications; extra X chromosomes or duplications of Xp or Xq; 22q13 deletions (Phelan-McDermid syndrome); 2q24 deletions; deletions of 4q31; 5p15 duplication; 7q35 deletion; and 21q11 deletion.

Crooked teeth also occurred in children with 1q21.1 microdeletion; 1q23q25 duplication; 1q32q42 duplication; 2p11.2p13 deletion; 2p22.3 duplication; 2q32q33 deletion; 3p25 deletion; 4p duplication; 4q28q35 duplication; 6q12q14 deletion; 6q16.3 deletion; 6q22q23 deletion; 7q22q31 duplication; 8q12q22 duplication; 9p23 deletion (Alfi syndrome); 9p duplication; 9q33q34 deletion; 11q24 deletion; 12q21 deletion; 13q13.3 deletion; 13q14q22 deletion; ring 13;



14q11q13 duplication; maternal uniparental disomy 14; idic 15; 15q13.3 deletion; 16p11.2 microdeletion; 16p12 deletion; 17p11.2 duplication (Potocki-Lupski syndrome); 17q12 deletion; 18q21 deletion; 20p12.3 deletion; Emanuel syndrome; and dual imbalances between chromosomes 1 and 6; 2 and 18; 3 and 8; 4 and 9, 10, 13, 15 or 18; 6 and 10; 8 and 12; 15 and 22; 16 and 18; 18 and 21 or 22; and 21 and the Y chromosome.

## Teeth in the wrong place

Teeth may erupt in the wrong place, in particular the upper canine teeth, which can become impacted against the roots of the incisor teeth, or even erupt in the roof of the mouth. These are called impacted or ectopic canines. Your child's dentist will be able to say whether they can be left alone, removed, or more complex treatment can be done to correct the position. It is normal for referral to be made for a specialist opinion, often to a hospital-based paediatric dentist or orthodontist.

Unique's records show that ectopic eruption occurs in many children, including those with a 4p16p15 duplication; 6q16q22 deletion; 10p duplication; ring 10; 18q12q21 deletion; 20q11q13 deletion; ring 20; an extra Y chromosome; and a 9; 14 imbalance.



## Crowded teeth

Crowded teeth are a common complaint among Unique members – more so than teeth with gaps. The cause may be big teeth, a small jaw, extra teeth, odd tooth positions, or a mixture of any or all of these. Both first and adult teeth can be crowded. Teeth can be so crowded they overlap, occasionally to give the appearance of parallel rows. Crowded teeth are more prone to decay because they are more difficult to clean. Encourage brushing after every main meal, use a high concentration fluoride toothpaste, and limit sweet, sticky food and starchy foods. Fluoride mouthwash can be difficult to use frequently enough to be effective. The current recommendation for home fluoride use is to use a specially prescribed high fluoride concentration tooth paste, and spit but not rinse after brushing. In severe crowding, judicious extraction of some permanent teeth may help relieve crowding and aid oral hygiene, but this should be planned very carefully and agreed by all parties involved.



A dentist's view of crowded teeth

Unique's records show that crowded teeth were especially common among children with 4p duplications (typically widely spaced top teeth and crowded bottom teeth); 15q24 deletions; Potocki-Lupski syndrome (17p11.2 duplications); 18p deletions and duplications; 2q33.1 deletions; 2q13q21 duplication; 4q25q27 deletions; 6p24 terminal deletion; duplication of 9p; 18q deletions; 7q22q31/2 deletions; 14q32 deletions; and mosaic ring 22. Crowded teeth also occurred in children with 1q41q44 deletion; 2p23p25 deletion; 2q24 deletion; 2q37 deletion; 4q31 deletion; 4p13p12 duplication; 4q28q35 duplication; 5q15q22 deletion; 5p15 duplication; 6q23q24 deletion; 7p15p14 deletion; 7q36 deletion; 8p23 deletion; 8p23p12 duplication; 9q31q33 deletion; 9q34 duplication; 10p11p12 deletion; 10p14 terminal deletion; 10q22 deletion; 10q25q26 duplication; ring 13; 14q21 deletion; maternal uniparental disomy 14; 15q25 deletion; 15q26 deletion; idic 15; 16p and 16p13.3 duplication; 16q12q22 duplication; 16q13 duplication; 22q11.2 microduplication; 22q13 deletion (Phelan-McDermid syndrome); diploidy triploidy; an extra X or Y chromosome; Xp11.2 duplication; and dual imbalances involving chromosomes 1 and 22; 2 and 7; 4 and 8; 4 and 10; 9 and 10; 9 and 14; 11 and 14; 12 and 13; and 6, 13 and 18.

## Size

Tooth size is largely regulated by genes. Some people have bigger teeth, some smaller. An abnormally large tooth is called a megadont. An abnormally small one is a microdont. About 1:20 of the general population has a big difference in the size of the top or bottom teeth. Among children with chromosome disorders, teeth may be consistently large, or small, or of uneven sizes.

## Small teeth

### Word

#### **Microdontia** Small teeth

Just one or two teeth can be small, most often the teeth next to the top front teeth (maxillary lateral incisor). Usually the root is also unusually small, but sometimes it can be malformed. Very small teeth often lack the complex structure of a normal-sized tooth. Gaps between very small teeth make them easier to clean, but occasionally make biting and chewing harder.

Some chromosome disorders are associated with small teeth. There is a syndrome where children are very short, their teeth are tiny and abnormally shaped, and the molars have no roots. This is caused by losing the *PCNT* gene (21q22.3: 47,743,975-47,865,681).

Unique's records show that tiny teeth were common among children with 6q16 deletions; 7q11.23 deletions or duplications;



Very small teeth can make biting and chewing harder.

9q34 deletions; 16p13.3 deletions and duplications. Tiny teeth also occurred in children with 1q43 terminal deletion; 2q24.2 deletion; 2p24p21 duplication; 2q31 duplication; 3q13 deletion; 4q31 deletion; 4q32 terminal deletion; 4q34q35 deletion; 5q15q22 deletion; 7q36 duplication; 8p23 terminal deletion; 8p23p21 duplication; 9p22 terminal deletions (Alfi syndrome); trisomy9p; 10p15 deletion; 10q26 deletion; 12p12p13 duplication; 17p13.3 deletion; 17p12p10 or p11.2 duplications; 17p13.3 duplication; 22q13 deletion (Phelan-McDermid syndrome); Xq28 duplication; extra X or an extra Y chromosome; and dual imbalances between 4 and 20; 7 and 5 or 8; 8 and 9 or 12; X and 2 chromosome.

## Large teeth

### Words

**Macrodonia** Large teeth

**Megadont** A large tooth

Just one or two teeth can be very big (megadont), most often a top front tooth or a bottom second premolar. Or all the teeth can be very big. The root can also be unusually large.

The *FGF3* gene (11q13: 69,624,735-69,634,191) can influence tooth size and shape. When this gene is lost, as 11q13 deletion syndrome, the canine and molar teeth are hugely enlarged and bulbous with almost no discernible cusps or grooves. This is known as **globodontia**.

Unique's records show that large teeth were especially common among boys with an extra Y chromosome, or extra X chromosomes, especially 3 extra X chromosomes (49,XXXXY).

Large teeth also occurred in children with a 2q37 deletion; 3q29 deletion; 6q23q25 duplication; trisomy 8 mosaicism; inverted duplication with deletion of 8p; 9q34 deletion (Kleefstra syndrome); 12p13 duplication; 13q22q32 deletion; 16q12q22 deletion; 18q22 deletion; ring 22; Xp22.3 duplication; a complex imbalance involving chromosomes 6; 13 and 18; and dual imbalances involving chromosomes 1 and 17; and 13 and 18.

## Taurodont teeth

Taurodont (literally, bull-like) teeth look normal in the mouth, but an X-ray will show an abnormally elongated pulp chamber. The pulp chamber is the part of the tooth inside the dentine that contains the tooth's nerves and blood supply.

Taurodontism only causes problems if there is gum disease, otherwise not.

Many genes are believed to be involved, including genes on the X chromosome.

Girls with Turner syndrome (with only one X chromosome) can have unusual tooth roots, including very short ones. Boys and girls with extra X chromosomes can have teeth with extra long roots.

Taurodonts, most often molars, are seen in children and adults with extra X chromosomes; 18p11.3 deletion; Smith-Magenis syndrome; Williams syndrome; cleft lip and palate; and 1/3 people with Down syndrome, as well as a range of other non-syndrome chromosome disorders.

## Unusually shaped teeth

### Words

**Double teeth** Joined teeth Fused teeth Geminated teeth

Odd-shaped teeth can grow separately, or be fused with a neighbouring tooth. When they are fused, the double tooth can be joined at the crown, the roots or both. Double teeth are more common in first teeth, usually the bottom front teeth. The teeth most often involved are the front teeth and the first canines. When first teeth are fused, it is more common for the adult tooth to be missing. Fused teeth occurred in children in Unique with a 1q21 deletion; 4q21 deletion; 4q32 terminal deletion; 7q11.22 deletion; 7q31q34 duplication; 7q36 deletion; 11q23 triplication; trisomy 14 mosaicism; 17q24 triplication; a 4; 18 imbalance. Similarly, a single root can give rise to two tooth crowns.

Teeth can be curved or rounded; jagged or crinkly on the incisal edge; triangular; peg-shaped; or square. The front teeth can have a cusp on the tongue side (so-called 'talon cusp'), or alternatively be hollowed out into a 'shovel' shape. Most of these variations have many causes, and some depend partly on ethnic origin. First and adult upper molars can often have an extra cusp on the palate side.

Unique's records show no particular disorders where unusually shaped teeth are common. They occurred in children with 2p13 deletion; 2q24 deletion; 2q11.2q21 duplication; 3q27 deletion; 4p duplication; 7q31q33 deletion; 5q15q22 deletion; 7p15p12 deletion; 7q35 deletion; 10p15p11.2 duplication; 10q26.3 deletion; trisomy 14 mosaicism; 15q26 interstitial deletion; 16q22q24 deletion; 17p11.2 duplication (Potocki-Lupski syndrome); multiple extra X chromosomes; and dual imbalances between chromosomes 4 and 7, 8 or 22; 7 and 18; 8 and 2 or 3; and 9 and 20.

When one of the upper lateral incisor teeth is missing, the one on the other side is sometimes peg-shaped. Specifically peg-shaped, small teeth were seen in children with 7q22q31 duplication; an extra Y chromosome; and dual imbalances between chromosomes 4 and 20; and 5 and 6.

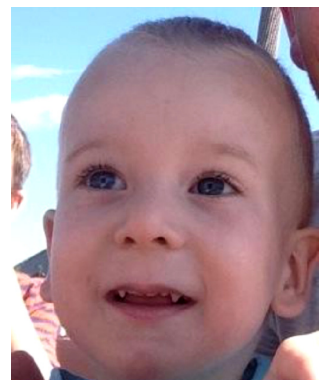
Sharp conical teeth have been seen in children with a 1q21.1 deletion; a 7q34 deletion; a 14q32 duplication; an extra X chromosome; and a dual imbalance between chromosomes 4 and 8.



Fused baby teeth, with decay



Fused adult teeth



Canines (cuspids) are 'fang'-like in a child with Pierre Robin sequence and small jaw

The shape of teeth can be chiefly cosmetic, but it can also cause problems with occlusion, biting and chewing. If needed, the abnormal tooth shape can often be easily disguised by use of bonded tooth-coloured resin materials. This requires good co-operation for the bonding steps and shaping to be carried out, but no injections, drilling or damage to the teeth should be needed. Always resist or question offers by a dentist to file down pointed teeth or drill the tooth in preparation for a permanent crown. These procedures are irreversible, may leave the tooth very sensitive, and should not be considered until young adulthood.



Irregular teeth

### Poor enamel and dentine

Poorly developed enamel can be generally thin, or have pits, ridges and grooves in its surface. When the tooth comes through, the enamel can turn a buff, orange or brown colour and is quickly and easily worn away. Sometimes just one tooth is affected, or a group of teeth, or all the teeth.

Most enamel defects are not genetic in origin. A useful source of information is the website <http://www.thed3group.org>.

When more than one adult tooth has poor enamel, the cause can be illness in a baby or a serious nutritional deficiency while the tooth was forming. A disturbance around the time of birth can affect the tips of the front adult teeth and the biting surfaces of the first adult molars, as well as the first teeth. This is because the cells that lay down the enamel are among the cells in the body that have the most sensitive nutritional needs.

Genes on the X and Y chromosomes give instructions for making amelogenin, the most abundant protein in the formative tissue of tooth enamel. A gene on the X chromosome (*AMELX*, see *Genes*) accounts for the great majority of the protein.

Poor enamel formation and poor dentine can be hard for a parent to distinguish. You may only see that your child's tooth or teeth are a normal shape but look blue-brown, shiny and translucent (opalescent) and are soft. Often the dentine is affected and the enamel covering breaks down because the dentine beneath is weak. Exposed dentine then rapidly wears away so the teeth look short. In severe cases the teeth can wear down almost to the gums. In other cases, the teeth have to be coated, sealed, extracted, or capped or crowned with steel or porcelain. In many children with a chromosome disorder tooth grinding makes this worse. First teeth are usually more affected than adult teeth, but both are involved.



Enamel defect on a molar tooth

The most common dental genetic disease is dentinogenesis imperfecta type II. The gene underlying this condition has

been mapped to 4q, as have some of the proteins that make up the enamel. Defective tooth enamel (amelogenesis imperfecta) has also been found in children with 4q deletions. It is then no surprise to find that many children with a 4q deletion, specifically between 4q12 and 4q21, are reported to have poor teeth.

Unique's records show that poor enamel was especially common among children with a 4q12q21 deletion; trisomy 8 mosaicism and boys with extra X chromosomes, especially 48,XXXX. It was found repeatedly among children with a 4p duplication; 5q15q22 deletion; a 5q35 deletion; 6p24/5 deletion; 8p23 deletion; a 17q21.31 deletion (Koolen de Vries syndrome); and a 22q11.2 deletion.



Dentine defect affecting first teeth

Poor enamel also occurred in children with a 1q21.1 deletion; 1p36 duplication; 2q37 deletion; 3p26 deletion; 4p12 deletion; 7q21q22 deletion; 7q34 deletion; 7q31 deletion; trisomy 9 mosaicism; 10q25 deletion; 11q23 triplication; Pallister Killian syndrome; 13q31 terminal deletion; 14q12 duplication; 15q12 deletion; 17p12 duplication; 17q12 deletion; 18p deletion; 18q23 deletion; 19p13.3 deletion; ring 20; ring 22; trisomy 22 mosaicism; and

Yq11.23 deletion. It also occurred in children with dual imbalances between chromosomes 1p and 22q; 2q and Xq; 3p and 16p; 4p and 20p; 4q and 22q; 8 and 9; 9 and 18; and 14 and 22. A child with an imbalance between 4 and 22 had teeth so soft they could not hold a filling.

Unique's records show that decay was especially common among children with an 18p deletion; extra X chromosomes, XXYY or other X chromosome variations, including Xp11.23 duplication.

It was found repeatedly among children with 2q37 deletion; 6p terminal deletion; 7q21 deletion; 10q26 deletion; 13q22q32 deletion; 16p11.2 deletion; 17p12p10 duplication; 22q13 deletion.

It was also found in children with 1p36 deletion; 1q42 deletion; 2q12q13 deletion; 2q13 duplication; 2q32 deletion; 2q duplication; 3q21q26 duplication; 3q28 deletion; 3q25 duplication; 4q27 duplication; 5p15 duplication; 6q26 deletion; 7q11.2 deletion; duplication of 7q11.23; 8p11p21 deletion; inverted duplication of 8p; 9p22 deletion; 9p24 deletion (Alfi syndrome); tetrasomy 9p; 9q12q21 deletion; trisomy 9 mosaicism; 10q duplication; 11p duplication; 11q25 deletion (Jacobsen syndrome); 12p duplication; 12q21 deletion; 14q deletion; 15q11.2 deletion; 15q11q14 duplication; 15q13.3 deletion; 15q22.3 duplication; 16p11.2 duplication; 17p11.2 deletion (Smith Magenis syndrome); 17p11.2 duplication (Potocki Lupski syndrome); 17q21.31 deletion; tetrasomy 18p; 18q23 deletion; 20q11.2q13 deletion; 21q11q21 deletion; Xp11.23 duplication; XYY; and imbalances between 1q44 and 8q21; 3p25 and 8q22; 4p16 and 8p23; 4p16 and 20p13; 4q25 and 9p22; 5q27 and 3q25; 5q34 and 6p24; 16p12p13 and Xp11.23.

## Some genes

Many genes are involved in tooth development. The list below includes some that are known about, but much remains to be discovered.

*IRF6*: 1q32.2 1: 209,958,000-209,979,000 Deletion linked with missing teeth

*EDA* Xq13.1 X: 68,835,00-69,259,000 This gene is important in regulating tooth number. Disruption in the gene can cause teeth not to grow. Changes (mutations) can cause a syndrome involving the hair, skin and teeth.

*EDARADD* 1q42.2q43 1: 236,557,-236,648,000 Changes (mutations) cause abnormal teeth, hair and skin

*WNT10A* 2q35 2: 219,745,000-219,764,000 Important in regulating tooth number. Disruption can cause teeth not to grow. Implicated in mild ectodermal dysplasia-type conditions.

*PTH1R* 3p21.31 3: 46,919,00-46,945,00 Changes (mutations) are linked with teeth that never appear.

*TP63* 3q28 3: 189,348,000-189,615,000 A number of syndromes involving the skin and hair, with a wide range of tooth defects

*MSX1* 4p16.2 4: 4,486,000-4,865,000 Changes (mutations) linked with missing teeth, specifically second premolars and third molars. First teeth are usually normal. Other mutations of this gene lead to different patterns of missing teeth

*ENAM* 4q13.3 4: 71,494,000-71,512,000 Changes (mutations) cause poorly formed enamel, and a syndrome called amelogenesis imperfecta

*DSPP* 4q22.1 4: 88,529,00-88,538,000 Changes (mutations) in the dentin sialophosphoprotein gene play a role in dentine defects.

*PITX2* 4q25 4: 111,538,000-111,563,000 Certain changes (mutations) lead to abnormal tooth development

*APC* 5q22.2 5: 112,043,000-112,181,000 Changes (mutations) are linked with extra teeth

*SHH* 7q36.3 7: 155,595,000-155,604,000 Many different changes (mutations) in the *SHH* gene can cause problems with the development of the face, including the teeth especially around the middle of the upper jaw

*RECQL4* 8q24.3 8: 144,511,00-144,517,000 This gene is important in bone formation, and changes (mutations) are linked with tooth defects including short roots

*FAM83H* 8q24.3 8: 144,806,000-144,822,000 This gene is needed for proper incorporation of calcium into dental enamel.

*LTBP3* 11q12 11: 65,306,000-65,325,000 Changes (mutations) in this gene have been linked with specific missing teeth

*MMP20* 11q22.2 11: 102,447,000-102,496,000 This gene plays a central role in forming tooth enamel, and changes (mutations) are linked with the poor enamel syndrome called amelogenesis imperfecta

*UBR1* 15q15.2 15: 43,235,000-43,398,000 Changes (mutations) cause a disorder known as Johansson-Blizzard syndrome with tooth problems that include late first teeth, small teeth, and multiple missing adult teeth.

*WDR72* 15q21.3 15: 53,805,000-54,055,000 Deletions and changes (mutations) can cause imperfect enamel formation (amelogenesis imperfecta).

*DLX3* 17q21.33 17: 48,067,000-48,072,000 Changes (mutations) in this gene can cause enamel defects (amelogenesis imperfecta), small and underdeveloped teeth, or large teeth with enlarged pulp chambers (the part of the tooth inside the dentine that contains the tooth's nerves and blood supply).

*AXIN2* 17q24.1 17: 63,524,000-63,557,000 Changes (mutations) are linked with missing adult teeth.

*KLK4* 19q13.41 19: 51,409,000-51,413,000 Important in very early tooth formation. Changes (mutations) have been linked with enamel defects (amelogenesis imperfect).

*BCOR* Xp11.4 X: 39,910,000-40,036,000 Deletions and changes (mutations) can cause syndrome with missing teeth, late adult teeth and very large roots and crowns of several front teeth and canines.

*AMELX* Xp22.2 X: 11,311,000-11,318,000 Vital for proper enamel formation. Deletions and changes (mutations) can cause enamel defects, including amelogenesis imperfect.

*IKBK* Xq28 X: 153,769,000-153,796,000 Deletions and changes (mutations) can cause skin, hair and tooth defects, as well as immune deficiencies.

## Some syndromes

### 18p11.3 deletion

Many dental anomalies, including teeth that are late to appear, irregular teeth, decay, enlarged taurodont teeth and problems caused at the middle of the upper jaw caused by irregularities at the midline.

### 22q deletion

Dental problems include poor tooth enamel, excess cavities and crooked teeth.

### Rieger syndrome

*PITX2* mutation causes changes to the front part of the eye, and hypodontia, leading to some missing first and adult teeth, most often front and canine teeth. Other tooth anomalies include poor enamel formation, cone-shaped teeth, short roots, taurodontism, and teeth late to come through. The dental anomalies differentiate Rieger syndrome from Axenfeld-Rieger malformation. Genes involved apart from *PITX2* are *FOXC1* and *GJA1*.

### Cleidocranial dysplasia

Dental anomalies in children with cleidocranial dysplasia can include first teeth that are very late to fall out, late eruption of adult teeth, supernumerary (extra) teeth and misalignment of the teeth and jaws. Changes (mutations) in the *RUNX2* gene (6p21: 45,328,000-45,551,000) are the cause.

### Down syndrome

70 per cent of females and 90 per cent of males with Down syndrome have some missing teeth. Taurodont teeth are seen in around one in 3. Crowns and roots are frequently short, apparently reflecting general growth delay in the



developing teeth. Teeth generally erupt late.

### **Holoprosencephaly**

Failure in the process by which the brain divides into right and left hemispheres, associated with severe facial anomalies but sometimes seen only with a single front tooth. Numerous genes identified, most commonly *SHH* at 7q36.3, but also *SIX3* at 2p21; *TGIF* at 18p11.3; *ZIC2* at 13q32; and *PTCH* at 9q22.

### **KBG syndrome (ANKRD11 changes)**

Large permanent upper central incisors

### **Langer-Giedion syndrome**

Dental anomalies include tiny teeth, late eruption, and extra teeth. Deletions and changes (mutations) in *TRPS1* (8q23.3: 116420723-116713298) are the probable cause.

### **Rubinstein-Taybi syndrome & 16p13.3 duplication**

Caused by deletion of *CREBBP* in 16p13.3. Dental effects include a specific type of cusp called a talon cusp; screwdriver-shaped front teeth; thin enamel; and over- or under-bite. Duplication of 16p13.3 has only recently been identified but small teeth are common.

### **Williams-Beuren syndrome 7q11.2 deletion**

Affected people have a range of dental anomalies including missing teeth, small, screwdriver-shaped incisors, and significantly short roots, as well as taurodont teeth.

### **Wolf Hirschhorn syndrome**

Dental anomalies include late eruption; fused front teeth; oligodontia; and missing teeth. Oligodontia is probably caused by the loss of *MSX1* at 4p16.2.

### **Smith Magenis syndrome**

Dental anomalies are common, and include missing teeth, most often the premolars and incisors; small crowns; screwdriver-shaped or tapered teeth; taurodont teeth; sharp bends or curves in the root or crown of the teeth; and protrusion of the lower front teeth.

### **Sotos syndrome**

Early emergence of the teeth; malocclusion; irregular teeth; excess wear and staining.

### **Syndromes with extra X chromosomes**

Taurodont teeth.

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## Resources

British Society for Disability and Oral Health [www.bsdh.org.uk](http://www.bsdh.org.uk)  
[www.dentalphobia.co.uk](http://www.dentalphobia.co.uk)

## Notes

## Support and Information



### Rare Chromosome Disorder Support Group,

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Please help us to help you!

This guide is not a substitute for personal medical or dental advice. Families should consult a medically or dentally qualified clinician in all matters relating to genetic diagnosis, management and health. Information on genetic changes is a very fast-moving field and while the information in this guide is believed to be the best available at the time of publication, some facts may later change. Unique does its best to keep abreast of changing information and to review its published guides as needed.

This guide was compiled by Unique and reviewed by Dr Mike Harrison, consultant in paediatric dentistry, Guy's Hospital, London, United Kingdom, and Steve Quance B.D.S., dental surgeon.

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