

# Duplications of 10q



## Duplications of 10q

A duplication of 10q is a [chromosome disorder](#). A chromosome disorder is a change in chromosome number or structure which results in a set of features or symptoms. People with a duplication of 10q have some extra genetic material on one of their 46 chromosomes. A duplication of 10q is sometimes also called a [10q trisomy](#) or a [partial 10q trisomy](#).

Chromosomes are made up of DNA held together by proteins. They are rod-like structures in the nucleus of the body's cells that carry genetic information (known as genes), telling the body how to develop and function. They come in 23 pairs, one from each parent, and 22 of the pairs are numbered 1-22 according to size, from the largest to the smallest. In addition to these 44 chromosomes, each person has another pair of chromosomes, called the sex chromosomes. Girls have two Xs (XX), whereas boys have an X and a Y chromosome (XY). Each chromosome has a short (p) arm (shown at the top in the diagram on the next page) and a long (q) arm (the bottom part of the chromosome).

For healthy development, chromosomes should contain just the right amount of material – not too much and not too little. People with a duplication of 10q have one intact chromosome 10, but there is an extra piece from the other and this is likely to affect their learning and physical development. Most of the clinical difficulties are probably caused by the presence of an extra copy (instead of the usual two) of a number of genes. The genes on chromosome 10, a medium-sized chromosome, represent about four per cent of the total number of genes in the human genome. However, a child's other genes and personality also help to determine future development, needs and achievements.

### Looking at 10q

You can't see chromosomes with the naked eye, but if you stain them and magnify them under a microscope, you can see that each one has a distinctive pattern of light and dark bands. You can see these bands in the diagram on the next page. They are numbered outwards starting from the point where the short and long arms meet (the [centromere](#)). A low number such as q11 is close to the centromere. Material closer to the centromere is called [proximal](#). A higher number such as q26 that is further from the centromere and closer to the tip of the chromosome is in a [distal](#) region.

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### Sources & references

The information in this leaflet is drawn from what is known about people with extra material from 10q. Many people have been described in the medical literature with a duplication of 10q. The first-named author and publication date are given to allow you to look for the abstracts or original articles on the internet in PubMed ([www.ncbi.nlm.nih.gov/pubmed](http://www.ncbi.nlm.nih.gov/pubmed)). If you wish, you can obtain most articles from *Unique*. The leaflet also draws on *Unique's* database. When this leaflet was written, *Unique* had 21 members with a pure duplication of 10q, with no loss of genetic material and no involvement of any chromosome arm other than 10q.

## The karyotype and results of molecular analysis

Your geneticist or genetic counsellor will be able to tell you about the breakpoints in your child. Your child will almost certainly be given a karyotype, a way of describing what their chromosomes look like. It is likely to read something like this

46,XX,dup(10)(q11.2q22.1)

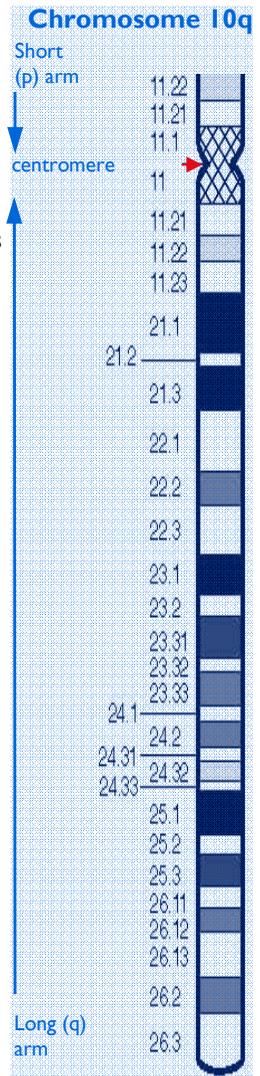
- 46 The total number of chromosomes in your child's cells
- XX The two sex chromosomes, XX for females; XY for males
- dup A duplication: there is extra material
- (10) The duplicated material comes from chromosome 10
- (q11.2q22.1) The chromosome has broken in two places. The first break is at q11.2 and the second break is at q22.1 so these are the ends of the extra section.

As well as a karyotype or instead of one, you may be given the results of a molecular test such as FISH or array-CGH for your child. The results are likely to read something like the following example

46,XX,add(10)(q26.3).arr cgh (10q26.3q26.3)  
(RPI1-264E18->RPI1-169F1)x3dn

- 46 The total number of chromosomes in your child's cells
- XX The two sex chromosomes, XX for females; XY for males
- add There is additional material
- (10) The additional material comes from chromosome 10
- (q26.3) The chromosome has broken in band 10q26.3
- .arr cgh The analysis was by array comparative genome hybridisation (CGH), also known as microarrays
- (10q26.3q26.3) This analysis showed two breaks in the chromosome, both in band 10q26.3
- (RPI1-264E18->RPI1-169F1)x3 This shows the part of the chromosome that is present in three copies instead of the usual two. The extra part includes two DNA markers, RPI1-264E18 and RPI1-169F1
- dn The duplication has occurred de novo or as a 'new event'. The parents' chromosomes have been checked and no duplication or other chromosome change found at 10q26.3. The duplication is very unlikely to be inherited and has almost certainly occurred for the first time in this family with this child.

You may wish to compare your child with others with the same duplication. It's important to remember that the same duplication can have different effects on different people and there will be differences, sometimes quite marked, between your child and others with an apparently similar karyotype or molecular results. It is very important to see your child as an individual and not to rely on direct comparisons with others who appear to have the same karyotype. After all, each of us is unique.



## Is there a 10q duplication syndrome?

With a total of 800-1200 genes on chromosome 10, it's inevitable that different individuals will have gained different genes. This makes it difficult to describe a specific 10q duplication syndrome. In the past it was believed that there was an overall trisomy 10q syndrome, involving recognisable facial features, heart anomalies, a cleft lip or palate (split in the roof of the mouth) and severe learning and other developmental difficulties (Yunis 1977). Now that molecular analysis can show more precisely how much extra chromosome material there is, it's more accurate to say that there are probably a number of different syndromes involving different parts of the long arm of chromosome 10.

People who have extra material from similar bands do share some similarities, as follows:

Where the duplication covers the **proximal** region from bands 10q11 to 10q22 (or a smaller region from 10q21 to 10q22) common features include short stature, a small head, a degree of developmental delay, problems with the eyes, heart defects, unusual features of the hands and feet and recognisable facial features (Fryns 1987; Aalfs 1995; Van Buggenhout 1996; Lam 2000; Nucaro 2002; *Unique*).

Where people have duplications of the end of the chromosome starting from bands 10q24 or 10q25, they may share enough features to have what is termed 10q trisomy, 10q duplication or **distal 10q duplication** syndrome. The syndrome typically involves eye, heart and kidney abnormalities - usually more severe when 10q24 is involved - together with unusual hands and feet, typical facial features including a high or cleft palate, a small head, a spinal curvature and some general effects of a chromosome disorder including slow growth and short stature, a need for significant learning support and low muscle tone. It has been suggested that this syndrome depends on duplication of band 10q25.2. However, the evidence for a distal 10q trisomy syndrome is tainted by the fact that out of well over 100 cases reported, no more than a handful have a 'pure' 10q duplication without involvement of any other chromosome arm (Tomkins 1983; Tonk 1996; Chen 1999; Migliori 2002).

“ He was a challenge when young but is the most wonderful young man who has brought endless joy into our lives, has good humour and a great capacity for self improvement



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## Duplications of proximal 10q11 to 10q22

Seventeen children and adults have been described from newborn to 39 years.

### What are the first signs that a baby or child has the disorder?

The first signs vary somewhat. While a few babies have an obvious birth defect, such as clubfoot, many do not. Many babies find feeding surprisingly difficult and facially, they may look a little unusual. All the same, the disorder may not become apparent until the second half of the first year when developmental milestones are missed.

### Pregnancy

For eight out of nine of the pregnancies described in the medical literature or to *Unique*, everything went normally. One mother experienced dizziness, nausea and fever at three months and felt little fetal movement but went on to deliver a 3.4kg (7lb 8oz) baby at term (Koivisto 1981). No babies were born prematurely and two were delivered at 42 weeks.

### Your baby at birth

Some babies - but certainly not all - were somewhat small and light for dates. The average birth weight at term of 12 babies was 2.882kg (6lb 6oz), the smallest weighing 2.2 kg (4lb 14oz) and the largest 3.4 kg (7lb 8oz).

Most babies were in reasonable condition at birth, scoring 8 or above on the Apgar scale (a measure of general wellbeing on a scale of 0-10). Three babies had difficulty establishing breathing and two experienced mildly prolonged jaundice but no babies had severe problems (Aalfs 1995; Van Buggenhout 1996; *Unique*).

Most typically, difficulties arise with feeding, with quite a few babies feeding slowly and not sucking strongly enough to satisfy their nutritional needs. These difficulties are not universal and some babies may breast or bottle feed efficiently. To help meet nutritional needs, babies may be given a high-calorie formula and fed from a bottle or through a naso-gastric tube passed through the nose and down the throat.

### Will my baby look different?

You and the doctors may notice that your baby has a slightly unusual facial appearance. A large number of unusual facial features have been noted by geneticists in reports on babies and children with a proximal 10q duplication. Your baby or child may have just one or two of these features or sometimes more and you may find that he or she looks more like others with a 10q duplication than like other members of your own family – or you may find that your baby looks just like the rest of the family. The most typical unusual features include: a small head (microcephaly); a prominent forehead; small, deep set eyes, sometimes with a skin fold at the inner corner (epicanthic fold); a squint (strabismus); an unusual (keyhole) shape to the coloured part of the eye (iris coloboma); an upturned nose; a bow-shaped mouth; a small lower jaw and chin; and flat, thick external parts of the ear (Lam 2000; Nucaro 2002; *Unique*).



## What about visible problems at birth?

Most babies do not look out of the ordinary at birth and while there is a known association between certain birth defects and 10q proximal duplications, the numbers of affected babies are small. Three babies were born with a clubfoot and three with webbed or extra fingers or toes. Two babies were born with a blind opening to the anus and one with a large number of strawberry marks (capillary haemangioma) on the face (Vogel 1978; Surana 1980; Fryns 1987; Aalfs 1995; Lam 2000; *Unique*).

## Feeding

Many newborn babies have difficulties establishing feeding and some of these are documented in the medical literature (Fryns 1987; Nucaro 2002). But feeding difficulties are not universal and at least one baby fed well from birth (Doheny 1997). Babies typically have difficulty maintaining their weight and growing on breast milk alone. Some babies breastfeed very slowly and in insufficient quantities; others are unable to suck properly, others to swallow or protect themselves from aspiration by coughing. Some babies thrive better on breast milk given from bottles with teats suitable for premature babies or those with a cleft palate and others need high calorie supplements to maintain their growth rate.

In addition to early feeding difficulties, quite a few *Unique* babies had gastro oesophageal reflux (where feeds and stomach contents return into the food passage and are often vomited or may be inhaled, causing chest infections, known as aspiration pneumonia). This can sometimes be controlled by giving feeds slowly, positioning a baby semi-upright for feeds and where necessary raising the head end of the bed for sleeping. If these measures are not enough, prescribed medications or anti-reflux milk help to keep feeds down.

Beyond the newborn period, *Unique* has some information on feeding histories. These show a range of further challenges, including late weaning; difficulties with chewing and a preference for semi-solid foods such as yoghurts and custards. Families report reluctance to take lumpy food or to self feed. With persistence and support, these difficulties are overcome, with pre-school children taking a wide variety of tastes and textures, albeit in small quantities. One adult with an unspecified duplication has thrived since childhood on a low-allergen diet.

“He has a wonderful appetite - 19 years

## Growth

The majority of children and adults with a 10q proximal duplication are unusually short and small for their family. In some children, the slow growth rate starts before birth. Most children and adults are below the average height for their age and some are exceptionally short, as small or smaller than the shortest three per cent of the population. However, it appears that most children maintain their growth rate on a percentile chart. The characteristic build is both short and slender. Adults are also short, and may be exceptionally so: known heights among adults are 138cm (4' 6") and 148 cm (4' 10") and one adult within *Unique* wears clothes for a 12-year-old (Reinthaller 1985; *Unique*).

## Development: sitting, moving, walking (gross motor skills)

Some delay is typical in reaching the developmental 'milestones' of sitting, becoming mobile and walking. This means that your baby will make progress, generally following the expected developmental sequence, but progress will come slower than in other children. How much slower depends chiefly on your baby's innate abilities, but also on opportunities, on stimulation and to some extent on therapeutic interventions. All children known to *Unique* have walked and most have done so before their second birthday. Abnormal muscle tone is a major contributory factor: some children have generalised low tone (hypotonia), while others have raised tone (hypertonia). Low tone makes a child or baby feel floppy to handle and generally improves and may resolve with maturity, physiotherapy and exercises. In some children, muscle tone increases, so that muscles remain unable to stretch and when children do walk they tend to walk on their toes. It is hard to predict eventual mobility, but while in some it is fairly normal, others may need supported seating and walking and a wheelchair long term.

From *Unique's* experience, babies learned to roll over between three and seven months, to sit without support between six and 20 months, to become mobile between 11 and 14 months and to walk without support between 12 months and six years. Not all babies crawl: some shuffle on their bottoms, scoot, roll or slide along. At first your child may walk with their feet wide apart to improve their balance and they may find uneven surfaces a particular challenge. For outdoors and long distances, children may still need a wheelchair (*Unique*).

## Development: hand use and coordination (fine motor skills) and self care

Children typically experience delay in controlling their hand use, although the delay may not be as great as in gross motor skills. Recurring themes in parental reports are poor coordination, a weak hand grip, and a delay in developing a pincer grip and holding objects. Small children find manipulating small objects such as buttons, poppers and zippers a challenge but with consistent training, adapted tools and verbal prompting many eventually achieve feeding and dressing skills. Undressing comes before dressing and finger foods before the use of spoons and other cutlery. In *Unique's* experience, children continue to need help and supervision to feed, dress and care for themselves throughout childhood.

In terms of self care, most youngsters achieve some collaborative independence in dressing, washing and personal care tasks. It may not be appropriate for parents to expect toileting to occur at the same age as other unaffected children.

“ He uses his fingers rather than cutlery to eat and a straw for drinks until the cup is almost empty. Due to lack of pressure and coordination difficulties, he can't wash himself or brush his teeth but he can dress himself with help with fastenings and is getting better at putting his socks on properly - 16 years

“ He takes himself to the toilet, cleans his teeth when prompted and dresses himself but needs help with buttons and to make sure he doesn't put his clothes on back to front - 19 years

## Learning

The evidence from the medical literature and from *Unique* is that children will benefit from extra support with their learning. How much support is needed usually only becomes apparent over time, but as a general guide, it seems that children will experience mild to moderate learning difficulties (Doheny 1997; *Unique*).

It's important to remember that youngsters with a learning disability are capable of considerable depth and complexity in their learning and may well acquire reading and writing skills.

“ He attended a mainstream secondary school with full support and passed school-leaving examinations in some subjects. He can read comics, books and magazines and use a keyboard. He is now at college following a ‘Towards Independence and Opportunity’ course for people with special needs in a small group of eight students. He has a good long-term memory and enjoys the computer, TV, reading, music, films and drama - 16 years

“ He attended a school for autistic children and from 16 a specialist school for the blind, graduating when he was 19. He has an excellent memory and learns easily if it's made fun. He started reading when he was 10 and is now an excellent reader, quite obsessed with dictionaries of which he has hundreds, including Spanish, Italian and German. He also has excellent keyboard and computer skills – and knows more than his tutor at college! - 19 years

This level of achievement will not be possible for all. It is important for any family with a child with a 10q duplication to approach their learning ability with an open mind, to ensure that she or he is regularly and thoroughly assessed and placed in a calm, stimulating and supportive learning environment where his or her strengths and abilities are recognised and built upon and weaknesses minimised.

## Speech and communication

Some information on speech and communication is available on nine children and adults but while information from *Unique* is more detailed, in the medical literature the information is generally more limited. It shows that while speech is somewhat delayed and may remain limited among those with a proximal 10q duplication, in general children do acquire language and some speak quite fluently. Generally the development of speech and language appears to reflect the child's cognitive abilities. Progress is slowed overall, with first words emerging late and only some children acquiring more complex speech patterns (Koivisto 1981; Reinhaller 1985; De Michelina 1991; Aalfs 1995; Doheny 1997; *Unique*).

Youngsters use a wide variety of methods to communicate their feelings and needs, including gestures, facial expressions, vocal sounds, pictures and objects of reference. Speech sounds are not always clear and understanding may be better than expression.

“ His speech really developed greatly when he started college at the age of sixteen. He asks for things he wants and uses 2/3 word and learned phrases. He is also an excellent mimic! He understands more than he appears to - we suspect he has selective hearing! - 19 years

## Behaviour

There is quite limited information on behaviour among those with a proximal 10q duplication. This suggests that some children are well adjusted socially and have no difficulties at all. Behaviour difficulties may occur when children are frustrated by their inability to communicate. Some children show repetitive and self-stimulatory behaviours but are not frankly autistic. One child has been prescribed methylphenidate to help increase attention and lessen hyperactivity. Children with rare chromosome disorders are no different from other children in responding well to firm and consistent behaviour techniques (time out, reward charts) and positive reinforcement of their good behaviours (Fryns 1987; Doheny 1997; Nucaro 2002; *Unique*).

“ A happy, cheerful boy with excellent manners and a lovely sense of humour who is accepted without question by other children in his mainstream school. He is caring and helpful and a child we are proud of - 16 years

“ He is sociable with people he knows well and likes but will not share, for example, his books. When he was young he was a challenge but he is now the most wonderful young man - 19 years

## Health matters

### ■ Eyesight

Some people with a 10q proximal duplication have normal eyesight. Others have been reported with a vision problem of varying severity. The most common problem is strabismus (a squint), looking inwards, outwards, up or down. The main effect of a squint is that one eye will usually be stronger than the other. Treatment depends on the cause but can include patching the stronger eye, exercises, glasses to correct a refractive error such as long sight and surgery to realign the muscles that hold the eye in place. Overall, strabismus is treatable and vision should not be seriously affected.

Other reported difficulties include errors of refraction (short or long sight) and a simple astigmatism, when the cornea, the clear cover over the iris and pupil, is abnormally curved, making objects appear blurred. These visual problems occur commonly in the general population and can generally be corrected by wearing glasses.

There are occasional reports of babies and children with significant eye defects that render them visually impaired or blind. These include microphthalmia (abnormally small eyes), coloboma (a developmental defect) and retinal dysplasia, in which the light-sensitive lining of the back of the eye does not grow and develop normally. One baby was reported with underdevelopment of the optic disc, the visible part of the optic nerve where the images we see are transmitted to the brain, and of the fovea, the shallow pit in the retina which is the region of greatest acuity of vision. Another baby had complex problems including opaque areas in the vitreous body, the clear eyeball.

Although only a small minority of babies and children have been reported with such significant eye defects, their severity means that all individuals found to have a proximal 10q duplication should have a thorough ophthalmological examination (Koivisto 1981; Fryns 1987; De Michelina 1991; Aalfs 1995; Van Buggenhout 1996; Lam 2000; *Unique*).

“ He has problems with peripheral vision and does not like stairs, ramps or anyone approaching from the side

## ■ Heart

Most babies with a proximal 10q duplication were born with a healthy heart: 4/17 are known to have been born with a heart defect. Heart defects ranged from a single, simple problem to complex problems necessitating surgery within days of birth. One baby was born with persistent ductus arteriosus (PDA), a persisting structure of the fetal circulation in which a channel between the aorta and the pulmonary artery that takes blood to the lungs fails to close shortly after birth. When it stays open, the lungs receive more blood than they should and the heart has to work too hard. It may close spontaneously but if it does not, it can be closed using minimally invasive surgery. Another baby was born with a PDA and a hole between the two lower chambers of the heart (ventricular septal defect, VSD). It is an individual decision whether and when a VSD needs to be closed surgically. A further child was born with complex heart problems involving holes between upper and lower heart chambers, malfunctioning valves and narrowing of the aorta that carries oxygenated blood from the heart to the rest of the body. *Unique's* experience has been that children have thrived even after complex open heart surgery (Koivisto 1981; Van Buggenhout 1996; *Unique*).

In terms of heart problems that might develop after birth, a 39-year-old adult was found to have a slightly enlarged heart with early arteriosclerosis in the aorta, but it was not known whether this was connected with the 10q duplication (Reinthaller 1985).

## ■ Feet

Four babies were born with one club foot or both (talipes). Treatment for an abnormal foot or walking position is individually tailored and aims to straighten the foot so that it can grow and develop normally. First-line treatment is non-surgical and may include manipulation, casting, taping, physiotherapy and splinting, followed by bracing to prevent relapse. Ankle or foot supports are often prescribed, as well as special footwear. Surgery and sometimes splinting are considered if non-surgical treatments are not completely successful. The foot position may relapse as the child grows and develops, making further surgery necessary (Vogel 1978; Van Buggenhout 1996; Lam 2000; *Unique*).

Other reported foot anomalies include clawed feet, where the arch is very high and the toes are pointed down, giving the foot a claw-like appearance, and webbed toes (Aalfs 1995; Nucaro 2002).

## ■ Anal atresia and kidneys

Most babies have been born with a normal outlet to the anus. However, in two babies the anus was blind, requiring surgery to open and reconstruct it. In one of the babies, the kidneys were entirely normal while in the other, one kidney was small and malpositioned but functioned well (Lam 2000; *Unique*).

## ■ Scoliosis

Three individuals have been reported to have a spinal curvature and in one adult the curvature was severe. A spinal curvature of the spine may correct itself in time but a progressive curvature can lead to problems sitting and if it is severe can cause heart

and lung problems. Treatment depends on the severity and progression of the curve but may involve wearing a body brace and surgery to fuse the vertebrae (Reinthaller 1985; Fryns 1987; Aalfs 1995).

### ■ Other conditions

There are individual reports of conditions affecting people with a 10q duplication that may or may not be caused by the chromosome disorder. These include: a malformation of the trachea (windpipe); slight abnormalities of the ribs; wide set or extra nipples; torticollis (the head tilts towards one shoulder and the chin rotates towards the opposite shoulder); undescended testicles; an inguinal hernia (in the groin); funnel chest; osteoporosis by the age of 8 (Vogel 1978; Koivisto 1981; De Michelina 1991; Aalfs 1995; Van Buggenhout 1996; Nucaro 2002; *Unique*).

### ■ Happy and healthy?

There are reports in the medical literature of babies and children suffering a high rate of infection, especially chest infections, in their early years. This is frequently found in the *Unique* population as well but has not been reported in this group. Generally, families report that once any surgery is complete, their children are indeed happy and healthy and do not have frequent illnesses or long-term conditions requiring medical intervention (Koivisto 1981; Aalfs 1995; *Unique*).

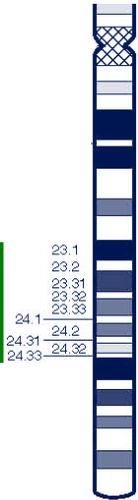
## Duplications of distal 10q23 to 10qter

It has been widely believed that individuals who have duplications of the end of the chromosome starting from bands 10q24 or 10q25 share enough features to have what is termed 10q trisomy, 10q duplication or **distal 10q duplication syndrome**. The syndrome typically involves eye, heart and kidney abnormalities - usually more severe when 10q24 is involved - together with unusual hands and feet, typical facial features including a high or cleft palate, a small head, a spinal curvature and some common effects of a chromosome disorder including slow growth and short stature, a need for significant learning support and low muscle tone. It has been suggested that the syndrome will develop when band 10q25.2 is duplicated. However, the evidence for a distal 10q trisomy syndrome is tainted by the fact that out of well over 100 cases reported, no more than a handful have a 'pure' 10q duplication without involvement of any other chromosome arm (Tomkins 1983; Tonk 1996; Chen 1999; Migliori 2002).

In this review, we consider only individuals with pure 10q duplications in the following three groups: 1 - people with small duplications of 10q23 and 10q24 on pages 12 to 14; 2 - eight people with duplications of varying sizes between 10q24 and 10q26 and four with duplications between 10q24 and the end of the chromosome on pages 15 to 19; 3 - two people with duplications between 10q25 and the tip of the chromosome, four with duplications between 10q25 and 10q26 and four with a duplication from 10q26 and the end of the chromosome on pages 19 to 29. A further baby with a 10q23qter duplication has been reported but sadly died at 15 days (Palutke 1981).

In all, twenty-seven individuals have been described with a distal duplication between 10q23 and the tip of the chromosome from newborn to 60 years.

## People with duplications of 10q23 and 10q24



Four children have been described with duplications of varying size, aged from birth to 11 years (Tonk 1996; *Unique*).

### What are the first signs that a baby or child has the disorder?

The first signs were developmental delay, identified between four months (maternal concern) and six years (school referral).

### Pregnancy and birth

Three pregnancies were uneventful and went to term but threatened prematurity disrupted the fourth in the sixth month and led to preterm delivery at 36 weeks.

Babies were within the normal range of size and weight for dates. Birth weights at term ranged from 3kg (6lb 10oz) to 3.3 kg (7lb 4oz).

Two babies needed oxygen at birth and one remained in special care for 10 days. One had a poor sucking reflex and another had low muscle tone (hypotonia); another was described as a floppy, cranky baby.

### One child



*She lost weight in hospital at 18 months*

### Will my baby look different?

Apart from wide set eyes noted in one baby, others had a normal facial appearance.

### What about visible problems at birth?

One baby had a slightly inclined foot, which was corrected by wearing a plaster cast for six weeks after birth. No other birth defects were reported.

### Feeding

In three cases no feeding difficulties were reported. One baby, fed on formula as she was too weak to breastfeed, developed gastro oesophageal reflux (GORD, GERD) at 17 months. In this condition, feeds and stomach contents return into the food passage and are often vomited or may be inhaled, causing chest infections, known as aspiration pneumonia. Reflux can sometimes be controlled by giving feeds slowly, positioning a baby semi-upright for feeds and where necessary raising the head end of the bed for sleeping. If these measures are not enough, prescribed medications or anti-reflux milk help to keep feeds down. In this case, the reflux did not respond to medication and the family tried homeopathic remedies and a non-milk diet with apparent success. This baby also had constipation which resolved with an anti-constipation milk formula (*Unique*).

## Growth

Two of the four children are tall for their age and a third is precisely average.

## Development: sitting, moving, walking (gross motor skills)

A mild delay in reaching the developmental 'milestones' of sitting, becoming mobile and walking is typical and may well be the first sign of the chromosome disorder. This means that your baby will make progress, generally following the expected developmental sequence, but progress will come slightly slower than in other children. How much slower depends chiefly on your baby's innate abilities, but also on opportunities, on stimulation and to some extent on therapeutic interventions. Abnormal muscle tone is a major factor with generalised low tone (hypotonia) reported. Low tone makes a child or baby feel floppy to handle and generally improves and may resolve with maturity, physiotherapy and exercises. Babies learned to roll over from 10 months, to sit without support between eight and 12 months, to become mobile between nine and 12 months and to walk without support around their second birthday.

## Development: hand use and coordination (fine motor skills) and self care

Children old enough to be toilet trained achieved this between four and five years.

“ To date, she has shown good coordination, in every way. She holds her spoon and tries to eat by herself and holds her bottle of milk with both hands - 19 months

## Learning

The evidence from the medical literature and from *Unique* is that children will benefit from some extra support with their learning. How much support is needed usually only becomes apparent over time, but as a general guide, it seems that children will experience mild to moderate learning difficulties. There can be marked differences even between brothers and sisters, with one boy with an IQ of 74 (borderline) at four years while his younger sister had a lower developmental quotient of 50 (Tonk 1996; *Unique*). Youngsters with a learning disability are capable of considerable depth and complexity in their learning and may well acquire reading and writing skills. Where learning difficulties are borderline or mild, the best school placement may not be obvious. Depending on local provision, a child

## Getting mobile



*In physical therapy*



16 months old



Typical posture



Enjoying playing with toys



Almost as tall as Daddy!

may start in a mainstream (regular) setting with support and move to a special environment as the need for extra therapies and input becomes more apparent.

Any family with a child with a 10q duplication should approach their learning ability with an open mind and ensure that she or he is regularly and thoroughly assessed and placed in a calm, stimulating and supportive learning environment where his or her strengths and abilities are recognised and built upon and weaknesses minimised.

### Speech and communication

Speech appears to be generally delayed but after a slow start and in some cases exposure to signing, children do acquire language and may speak quite fluently. Generally the development of speech and language appears to reflect the child's cognitive abilities. Progress is slowed overall, with first words and more complex structures emerging late. A four-year-old showed mild difficulty with pronunciation and clarity. Children communicate their feelings and needs in many ways, including gestures, facial expressions, vocal sounds and signing.

### Health matters

#### ■ Eyesight

None of the four children with a duplication between 10q23 and 10q24 had a serious vision problem. One child had a squint (strabismus) and long sight (hypermetropia) in one eye, corrected with glasses.

#### ■ Heart

One/ four children with a duplication between 10q23 and 10q24 had a heart problem, consisting of a hole between the two lower heart chambers (ventricular septal defect, VSD) corrected by surgery and an unusual formation of the valve leading from the heart to the aorta that might also need surgery.

#### ■ Feet

One baby had the position of one foot corrected in a surgical plaster (see [Visible problems at birth](#)) but other than this, feet were normal.

#### ■ Other conditions

There are individual reports of conditions affecting people with a 10q duplication that may or may not be caused by the chromosome disorder. These include: irritable hip; and allergic rhinitis (*Unique*).

## People with duplications of varying sizes between 10q24 and 10q26 and of 10q24qter

Twelve people have been described, aged between newborn and 60 years.

### What are the first signs that a baby or child has a disorder?

The first signs vary somewhat. While some babies had obviously unusual facial features - similar to a baby with Down's syndrome - or minor abnormalities of the feet such as webbed toes, others did not and an underlying problem was only suspected when developmental milestones were repeatedly missed (Roux 1974; Berger 1976; Back 1979; Tomkins 1983; Chen 2008; *Unique*).

### Pregnancy

For four out of five of the pregnancies described in the medical literature or to *Unique*, everything went normally. One mother experienced bleeding at two months and excessive amniotic fluid at four months (Berger 1976). No babies were born prematurely but one was delivered at 42 weeks.

### Your baby at birth

Some babies - but certainly not all - were somewhat small and light for dates. The average birth weight at term of six babies was 2.732kg (6lb), the smallest weighing 2.076 kg (4lb 9oz) and the largest 3.5 kg (7lb 11oz).

Most babies were in reasonable condition at birth but at least two had difficulty establishing breathing and required breathing support (Chen 2008; *Unique*).

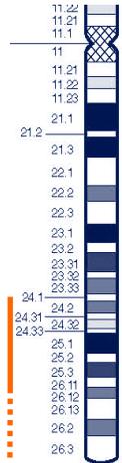
Among babies with a chromosome disorder, difficulties with feeding are common, with quite a few babies feeding slowly and not sucking strongly enough to satisfy their nutritional needs. These difficulties have not been noted in this group and some babies have breast or bottle fed efficiently.

### Will my baby look different?

You and the doctors may notice that your baby has a somewhat unusual facial appearance reminiscent of a baby with Down's syndrome. A large number of unusual facial features have been noted by geneticists in reports on babies and children with a distal 10q duplication. Your baby or child may have just one or two of these features or sometimes more and you may find that he or she looks more like others with a 10q duplication than like other members of your own family – or you may find that your baby looks just like the rest of the family. The most typical unusual features include: a high, broad forehead; a round flat face; widely spaced, upwards slanting and small eyes, sometimes with a skin fold at the inner corner (epicanthic folds); fine eyebrows; low set ears; a cleft palate; a short, upturned nose with a flat bridge; a bow-shaped mouth; a small lower jaw and chin; and a short neck (Chen 2003).

### What about visible problems at birth?

Some babies, but not all, have slightly unusual hands or feet with minor anomalies such as webbing or wide gaps between toes and unusually placed thumbs. Other than this, most babies look normal, if somewhat small at birth (Berger 1976; Back 1979; Tomkins 1983; *Unique*).



## Feeding

Feeding difficulties are common in babies and young children with a chromosome disorder but have not often been reported in this group. One baby developed a behavioural feeding problem at 18 months after breastfeeding well to 12 months. With psychological help, the problem gradually improved over two years (*Unique*).

## Growth

The majority of children and adults with a distal 10q duplication are unusually short and small for their family. In some children, the slow growth rate starts before birth. Most children and adults are below the average height for their age and some are exceptionally short: known heights among adults are 122cm (4') and 146 cm (4' 9"). Where the legs are severely contracted, it may not be possible to establish a precise height with any certainty (Van de Vooren 1984; *Unique*).

## Development: sitting, moving, walking (gross motor skills)

Some delay is typical in reaching the developmental 'milestones' of sitting, becoming mobile and walking. This means that your baby will make progress, generally following the expected developmental sequence, but progress will come slower than in other children. How much slower depends chiefly on your baby's innate abilities, but also on opportunities, on stimulation and to some extent on therapeutic interventions. Most but not all children known to *Unique* have walked and have done so by their third birthday. Abnormal muscle tone contributes to mobility problems, as do contracted joints and spinal curvature: most children have generalised low tone (hypotonia). Low tone makes a child or baby feel floppy to handle and generally improves and may resolve with maturity, physiotherapy and exercises.

From *Unique's* experience and the medical literature, babies learned to roll over between six and 11 months, to sit without support between nine and 12 months, to become mobile from 11 months and to walk without support from three years. Not all babies crawl: some shuffle on their bottoms, scoot, roll or slide along. At first your child may walk with their feet wide apart to improve their balance and they may find uneven surfaces a particular challenge. For outdoors and long distances, children may still need a wheelchair (Tomkins 1983; *Unique*).

## Development: hand use and coordination (fine motor skills) and self care

Children typically experience considerable delay in controlling their hand use and need extensive support with the daily tasks of feeding, dressing and self care. Small children find holding and manipulating small objects a great challenge but with consistent training, adapted tools and verbal prompting may eventually achieve some feeding and dressing skills. Undressing comes before dressing and finger foods before the use of spoons and other cutlery. In *Unique's* experience, children continue to need help and supervision to feed, dress and care for themselves throughout childhood.

**"She can dress herself, brushes her own hair and teeth, puts on her shoes and can tie laces - 21 years**

## Learning

The evidence from the medical literature and from *Unique* is that children will benefit from extra support with their learning. How much support is needed usually only

becomes apparent over time, but as a general guide, it seems that the range of learning difficulty that children can experience varies from mild to severe (Roux 1974; *Unique*).

It's important to remember that youngsters with even a severe learning disability are capable of considerable depth and complexity in their learning and may acquire reading and writing skills.

“ She started to read at 8 and to write at 10 years of age. Now 21, she has an excellent memory, uses a keyboard, loves playing games on the computer, sends and receives emails and watches home movies again and again

This level of achievement will not be possible for all. Any family with a child with a 10q duplication should approach their learning with an open mind and ensure that she or he is regularly and thoroughly assessed and placed in a calm, stimulating and supportive learning environment where his or her strengths and abilities are recognised and built upon and weaknesses minimised.



17 years old

### Speech and communication

Speech is markedly delayed and remains limited among those with a distal 10q duplication, but in general children do acquire spoken language. Generally the development of speech and language appears to reflect the child's cognitive abilities. Progress is slowed overall, with first words emerging late and only some children acquiring more complex speech patterns. Youngsters use a wide variety of methods to communicate their feelings and needs, including gestures, facial expressions, vocal sounds, pictures and objects of reference. Signing is a valuable adjunct and some children progress to speaking after years of communicating their needs with signs. Speech sounds when they emerge are not always clear and understanding may be better than expression (Tomkins 1983; Van de Vooren 1984; *Unique*).

### Behaviour

There is quite limited information on behaviour among those with a distal 10q duplication. This suggests that behaviour difficulties may occur when children are frustrated by their inability to communicate or are required to change environment. Temper tantrums may occur. One child was diagnosed with PANDAS (paediatric autoimmune neuropsychiatric disorders associated with streptococcus infections). Children with rare chromosome disorders are no different to other children in responding well to firm and consistent behaviour techniques (time out, reward charts) and positive reinforcement of their good behaviours. Among adults there are mixed reports, with some adults leading helpful, compliant lives while others show some evidence of obsessive-compulsive and aggressive behaviours and have difficulties with social interaction (Van de Vooren 1984; *Unique*).

“ Her laugh is loud and robust, and makes everyone around her laugh loud and long

## Health matters

### ■ Heart

Most babies with a distal 10q duplication were born with a healthy heart: 4/12 are known to have been born with a heart defect. Heart defects typically took the form of a hole between the upper or lower heart chambers (atrial or ventricular septal defect, ASD or VSD). It is an individual decision whether and when an ASD or VSD needs to be closed surgically and in the cases known to *Unique*, the holes healed spontaneously (Tomkins 1983; Chen 2008; *Unique*).

### ■ Eyesight

Some people with a distal 10q duplication have normal eyesight. Others have been reported with a vision problem of varying severity. The most common problem is strabismus (a squint), looking inwards, outwards, up or down. The main effects of a squint are that the person will usually have one eye which is stronger than the other. Treatment depends on the cause but can include patching the stronger eye, exercises, glasses to correct a refractive error such as long sight and surgery to realign the muscles that hold the eye in place. Overall, strabismus is a treatable condition and vision should not be seriously affected.

Other reported difficulties include microphthalmia (abnormally small eyes) and a condition where the eyeball is set deep within the socket (enophthalmia) but the effects on vision are not known (Berger 1976; Back 1979; *Unique*).

### ■ Kidneys and urinary collecting system

Kidney problems have occasionally been reported in babies and children with a distal 10q duplication. A 3-year-old boy had tiny cysts in the outer part of the kidneys known as the renal cortex and there have been reports of enlarged kidneys, in one case associated with swollen, distended ureters and of enlargement of the renal pelvis, the part of the kidney that collects urine. One child was described with a double kidney and urine collecting system on each side. Treatment of kidney problems is individually tailored and may require surgery to prevent renal failure (Moreno-Fuenmayor 1975; Back 1979; Chen 1999; Chen 2003 ; Chen 2005; *Unique*).

### ■ Severely contracted joints

Four individuals have been reported with contracted joints, in one case so severe that walking was not possible. Other cases were less serious and chiefly affected the joints in the hands and arms (Berger 1976; Back 1979; *Unique*).

### ■ Scoliosis

Three individuals have been reported to have a spinal curvature and in one case the curvature was severe and progressive, restricting the space available for the lungs. A spinal curvature of the spine may correct itself in time but a progressive curvature can lead to problems sitting and if it is severe can cause heart and lung problems, as well as difficulties with walking and uneven leg length. Treatment depends on the severity and progression of the curve but may involve wearing a body brace and surgery to fuse the vertebrae (Back 1979; *Unique*).

## ■ Minor genital anomalies in boys

Minor anomalies of the genitals are more common in boys with a chromosome disorder than in those without. Two out of six boys were born with undescended testicles (cryptorchidism) (Chen 2003; Berger 1976). Treatment for undescended testicles depends on the suspected cause and is usually needed if the testicles do not descend naturally in time. The testicles can be brought down in a short operation under general anaesthetic called an orchidopexy.

## ■ Other conditions

There are individual reports of conditions affecting people with a distal 10q duplication that may or may not be linked with the chromosome disorder. These include: an inguinal hernia (in the groin); a narrowing of the duodenum, requiring surgical repair; onset of seizures from the age of 18 months; hypothyroidism (Tomkins 1983; *Unique*).

## ■ Happy and healthy?

There are reports in the medical literature and in the *Unique* population of babies and children suffering a high rate of infection, especially chest infections, in their early years. These infections can be very serious and in individuals have proved fatal. In most cases, once early childhood is past the frequent infections lessen and children go on to lead healthy, happy lives (Roux 1974; Chen 2003; *Unique*).

## People with duplications between 10q25 and 10q26 and of 10q25/6qter

Ten people have been described, aged from newborn to 15 years (Miró 1980; Hoo 1995; Migliori 2002; *Unique*). It is generally stated that people with duplications of the end of the chromosome have similar features to those with a larger duplication from 10q24 but are more mildly affected (Schinzel 2000).

## What are the first signs that a baby or child has the disorder?

The first signs vary. In two cases the chromosome disorder became evident during pregnancy, once when serum screening suggested a raised risk for a chromosome disorder such as Down's syndrome and once when amniotic fluid was lost from 18 weeks and preterm labour followed with birth at 28 weeks. Five babies were noted to have an unusual facial appearance at birth, two were small for dates and three had very low muscle tone and felt floppy to hold. One was an 'unhappy newborn'. Two children were identified at school age when their learning difficulties became apparent; one of these has a tiny microduplication almost at the tip of the chromosome within band 10q26.3 (Miró 1980; Hoo 1995; Migliori 2002; *Unique*).

“She was very unhappy and wouldn't feed after birth - very sleepy and unresponsive to stimulation

## Pregnancy

For four of the seven pregnancies described in the medical literature or to *Unique*, everything went normally. One mother had a twin pregnancy with one baby with the chromosome disorder and the other chromosomally normal. In one case the baby's small size and slow growth were noted at 20 weeks. One baby was born, small for dates, at 28 weeks (Hoo 1995; Migliori 2002; *Unique*).



## Your baby at birth

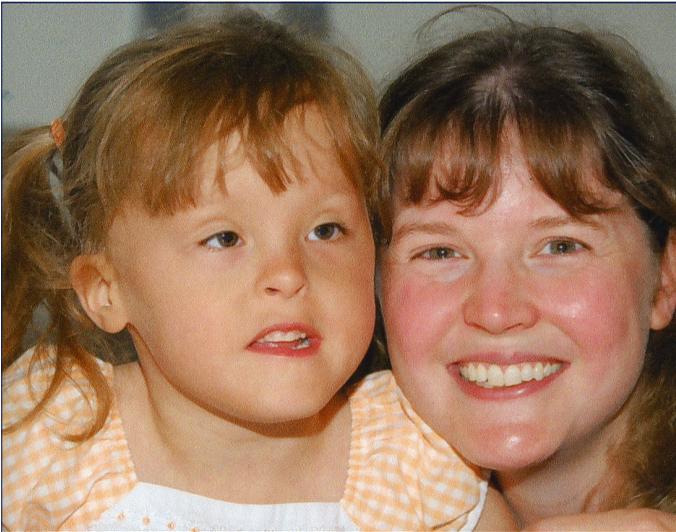
Most babies were born an appropriate weight and size for dates. The average birth weight at term of seven babies was 3.117kg (6lb 14oz), the smallest weighing 2.664 kg (5lb 14oz) and the largest 3.685 kg (8lb 8oz).

Three babies had difficulty establishing breathing but in two cases this was due to other factors (cord round neck; twin preterm birth). One baby was small for dates and developed jaundice and three had noticeable hypotonia. One baby developed chronic lung disease after a preterm birth and long-term oxygen. Apart from an unusual facial appearance, one baby was noted to have inwards-turning wrists and feet but these resolved within six weeks of birth (Migliori 2002; *Unique*).

“ We were told she was a perfectly normal, healthy girl apart from a strawberry birthmark on her left cheek

Most typically, difficulties arise with breastfeeding, with quite a few babies sleeping a lot, feeding slowly and not sucking strongly enough at the breast to satisfy their hunger or nutritional needs. Some babies never get the hang of breastfeeding but bottle feed without problems, while others graduate from mixed feeding to breastfeeding after a few weeks. Facial hypotonia may make it difficult for a baby to make an effective seal while sucking, making even bottle feeding problematic (*Unique*).

## Will my baby look different?



4 years old

You and the doctors may notice that your baby has a slightly unusual facial appearance. A large number of specific unusual facial features have been noted by geneticists in reports on babies and children with a distal 10q duplication. Your baby or child may have just one or two of these features or sometimes more and you may find that he or she looks more

like others with a 10q duplication than like other members of your own family – or you may find that your baby looks just like the rest of the family. The most typical unusual features include: a round, flat face; narrowed eyes (blepharophimosis); hooded eyelids (ptosis); a short nose; low set ears and a short neck (Migliori 2002).

## What about visible problems at birth?

Apart from the slightly unusual facial appearance and somewhat unusual hands and feet (wide gaps between toes, overlapping fingers/ toes, webbing between fingers/ toes, single palm creases, tiny hands and feet) babies typically do not look out of the ordinary at birth or have birth defects (Miró 1980; Hoo 1995; Migliori 2002; *Unique*).



“His laugh and smile are contagious. He’s given us much joy

## Feeding

Once initial feeding difficulties are under control (see [Your baby at birth](#)), most babies feed well with a good appetite. Four babies developed significant gastro oesophageal reflux (where feeds and stomach contents return into the food passage and are often vomited or may be inhaled, causing chest infections, known as aspiration pneumonia). This can sometimes be controlled by giving feeds slowly, positioning a baby semi-upright for feeds and where necessary raising the head end of the bed for sleeping. If these measures are not enough, prescribed medications, thickeners or anti-reflux milk help to keep feeds down. In one case reflux settled on a low-allergy diet. Another baby responded well to a soy formula after developing eczema on a dairy-based formula.

Beyond the newborn period, children may have difficulties with chewing and show a preference for semi-solid foods such as yoghurts and custards. Families also report children putting too much food into the mouth at once. With support, these difficulties are overcome, with pre-school children taking a wide variety of tastes and textures.

Constipation is common among children with chromosome disorders. It normally responds to increased fluids and fibre but can be persistent and troublesome and prescribed suppositories and enemas may be needed. One child in this group suffered spectacularly with an enlarged colon and difficulty with bowel movements but was eventually settled on a natural enema of milk and molasses.

## Growth

There is no consistent effect of the 10q duplication on height. While some children and adolescents are short for their age, others are of average height and may be tall. There appears to be greater consistency in body build, which is slender and may be frankly thin so that a child of average height is underweight (Miró 1980; Hoo 1995; Migliori 2002; *Unique*).

“Average height but extremely slim build and a tiny frame - 4 years

“Tall for his age and lean. 75th percentile (according to American growth charts) for height, 50 per cent for weight. Shoulders appear slightly rounded. Chest is mildly concave - 8 years

## Development: sitting, moving, walking (gross motor skills)



7 years old

Some delay is typical in reaching the developmental 'milestones' of sitting, becoming mobile and walking. This means that your baby will make progress, generally following the expected developmental sequence, but progress will come slower than in other children. How much slower depends chiefly on your baby's innate abilities, but also on opportunities, on stimulation and to some extent on therapeutic interventions. Most children known to *Unique* have walked and some have done so before their second birthday. Abnormal muscle tone is a major contributory factor: most children have generalised low tone (hypotonia) and tire rapidly when walking. Low tone makes a child or baby feel floppy to handle but generally improves and may resolve with maturity, physiotherapy and exercises. Additionally, a significant number of children develop a spinal curvature that makes even, paced walking more difficult.

From *Unique's* experience, babies learned to roll over between six and eight months, to sit without support between seven and 16 months, to become mobile between 10 months and two years and to walk without support between 19 months and four years. Not all babies crawl: some shuffle on their bottoms, scoot, roll or slide along. Not all children have walked independently; one wheels himself in his wheelchair. Children who do walk may initially walk with their feet wide apart to improve their balance and they may find uneven surfaces a particular challenge. They may tire easily and for outdoors and long distances may still need a wheelchair (*Unique*).



“ Easy to please

“ Despite all his challenges he continues to work hard and try all types of new activities. He waterskied and kneeboarded this summer! - 8 years

“ He has weak legs and doesn't walk but scoots using his arms and wiggles to get toys. He walks in a gait trainer and wheels himself in his wheelchair - 9 years

“ She walks with her head pushed forward and has developed very rounded shoulders. She hates the orthotic boots she has to wear to counteract the effects of her leg shortened as a result of Perthes disease - 14 years

“ His unsteady gait has improved but he needs reminding to watch where he's walking. His physiotherapist is building up his tone - 15 years

## Development: hand use and coordination (fine motor skills) and self care

Children typically experience delay in controlling their hand use, although the delay may not be as great as in gross motor skills. Recurring themes in parental reports are poor coordination, weak hands and wrists and a delay in developing a pincer grip and holding toys, crayons and other objects. Small children find manipulating small objects such as buttons, poppers and zippers a challenge but with consistent training, adapted tools and verbal prompting eventually achieve feeding and dressing skills. Undressing comes before dressing and finger foods before the use of spoons and other cutlery. In *Unique's* experience, children continue to need help and supervision to feed, dress and care for themselves throughout childhood.

In terms of self care, most youngsters achieve quite a degree of collaborative independence in dressing, washing and personal care tasks. It may not be appropriate for parents to expect toilet training to occur at the same age as other unaffected children and in this group it was achieved very gradually during the childhood years.

“ In some areas he's right on target, in others a few years behind. He's totally toilet trained, no pull ups even at night. He brushes his teeth but with a little difficulty (coordination). He dresses himself (shirt, pants) but needs help buttoning and zipping and needs reminders to make sure his shirt is pulled down straight and to straighten his pant legs. He puts on his own coat and can zip independently. He puts his own shoes on using Velcro fasteners. He still has a hard time with scissors and cutting and coordination is a little difficult - 15 years

“ She has a tremor but can feed herself. Her coordination has improved but is not yet perfect. She is still in nappies at night and needs help with all her personal care but is trying more now - 14 years

“ He can hold a bottle and a sports cup with a strong grip but he doesn't like to hold spoons due to sensory issues. He is still in nappies. He can pull off loose clothing and helps pulling on his shirt - 9 years

“ He could hold his own bottle at eight months. He has difficulty writing (forming letters), cutting and colouring neatly but can dress himself and brush his teeth though he needs some help with personal grooming - 8 years

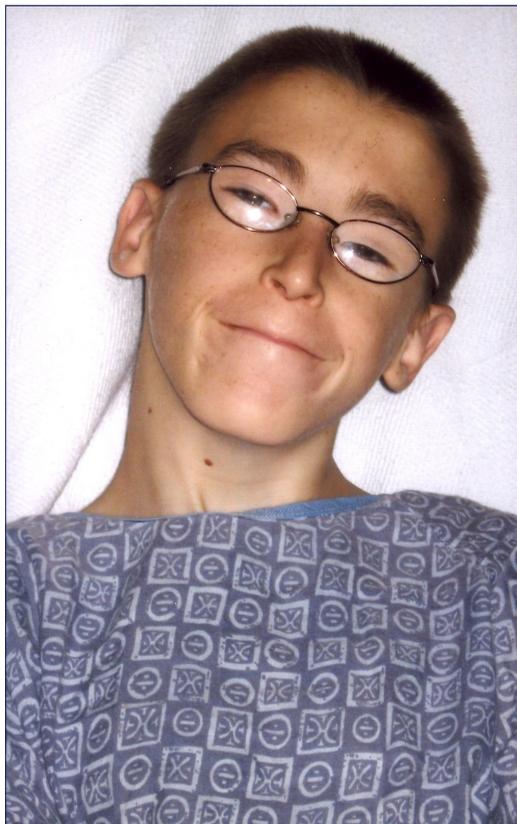


“ She now gives hugs and kisses

## Learning

The evidence from the medical literature and from *Unique* is that children will benefit from extra support with their learning. How much support is needed usually only becomes apparent over time and cannot at the moment be inferred from the position or extent of the chromosome duplication. The range of learning difficulty is wide, with

some youngsters experiencing slight difficulties while others are severely affected. Some youngsters are educated in mainstream (regular) classrooms with support and others in special needs environments but what is important is to approach the child's learning ability with an open mind, to ensure that she or he is regularly and thoroughly assessed and placed in a calm, stimulating and supportive learning environment where his or her strengths and abilities are recognised and built upon and weaknesses minimised. Youngsters with a learning disability are capable of considerable depth and complexity in their learning and – as the parental accounts below show – may acquire quite advanced reading and writing skills. Overall, the evidence from *Unique* suggests that children acquire basic literacy skills around the ages of 8-10 years (*Unique*).



“ He loves school and is well adjusted. He has an excellent memory, remembering in detail from years before. He loves reading and in 2007 received an award for literacy. His current teacher said his reading progress was fantastic. He can read almost anything in front of him and spells most words correctly. He writes his name, address, phone number, the names of family members – almost anything, but with a certain amount of difficulty. He finds maths and knowing how to add and subtract things hard but can count well past 100 - 15 years

“ She has a very good memory and has no problem learning the words to songs. She has been reading since she was nine but reads very little and is not interested in computers but enjoys music, dolls and prams - 14 years

“ He loves music and hitting keys on the piano and shows he recognises people he hasn't seen in years by clapping and vocalising happy sounds. He's educated at home and hospital school at home - 9 years

“ A determined guy who lets little stand in his way

“ His chromosome disorder came to light because at seven years he was struggling in school with some learning disabilities. His long term memory is excellent, but short term memory is challenged and he needs continuous repetition or reinforcement of topics. He recognises faces, names and situations that contain emotion. He's a determined learner and a very hard worker and pleasant to work with. At eight years, he's reading readers for children two years younger than himself and has some

difficulty with fluency in reading. He draws simple stick figures and is learning cursive writing in school, which he finds very challenging. He attends a public (mainstream) school where he is integrated into a regular classroom with an aide - 8 years

“ She has an excellent memory, is a very tactile learner and does well with visual stimulation in a natural play environment. She can draw most shapes and fill in a picture of a face. She attends a private school for children with autism - 4 years

### Speech and communication

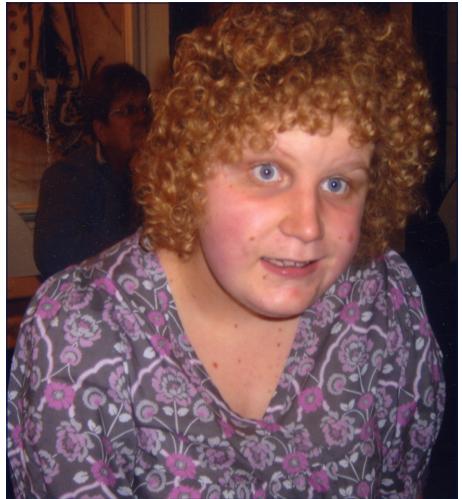
Some information on speech and communication is available on seven children and adolescents but while information from *Unique* is quite detailed, in the medical literature the information is generally more limited. It shows that while speech is delayed and may remain limited, among those with a distal 10q duplication most children do acquire language and some speak quite fluently. Generally the development of speech and language appears to reflect the child's cognitive abilities. Progress is slowed overall, with first words emerging late - from 18 months to three years - and only some children acquiring more complex speech patterns. Youngsters use a wide variety of other methods to communicate their feelings and needs, including gestures, facial expressions, vocal sounds, pictures and objects of reference. When speech emerges, sounds (particularly specific consonants) are not always clear and understanding may be better than expression (Hoo 1995; *Unique*).

“ He communicates with speech, expressing himself and verbalising well using full sentences. Sometimes he has difficulty with the sound *f* but if he is not understood, will spell a word out - 15 years

“ She uses words to communicate. She has a good understanding but can't express herself very clearly and her vocabulary can become confused. She has problems hearing at certain pitches and her pronunciation can be difficult for some people to understand but she will not be ignored by anyone. Verbally, she is a star with a wicked sense of humour - 14 years

“ He babbled at 6 months and was signing by 7 years. Now he uses vocal noises, gestures, 10 signs and one or two words (mom, no, oww). He makes choices by touching pictures and pushing switches on his communication device/ computer. He finds it hard to say *k*, *g* and *t* - 9 years

“ He communicates by speaking but is very inconsistent with testing so is difficult to assess. He has expressive language delays and processes language slowly. As a baby under one year he grunted but was speaking simple words by 18 months. Today he still has difficulty enunciating words clearly and discriminating between certain sounds such as crown and clown - 8 years



14 years old



“ She shortens nearly all words

### Behaviour

The limited information on behaviour among those with a distal 10q duplication suggests that many behaviours are typical for others with a learning difficulty or other chromosome disorder. In a calm, familiar environment children can be loving, sweet and empathetic and show a great sense of humour. They are likely however to behave like a younger child, so you may find a school-age child playing alone rather than with others, or a 10-year-old throwing a temper tantrum. They can react strongly to disturbance, disliking interruptions or changes to a familiar routine and noisy, overly busy environments. They may have difficulty with social interactions and misunderstand social cues, being either too familiar or too friendly with strangers. Generally speaking, they respond better to adults than to other children of their own age and need to be taught social skills. Some children are easily frustrated and can act out their feelings in unacceptable ways (temper tantrums, hitting out). Children with rare chromosome disorders are no different to other children in responding well to firm and consistent behaviour techniques (time out, reward charts) and positive reinforcement of their good behaviours.

A minority of children display autistic tendencies, such as repetitive or obsessive behaviours. Overactivity and hyperactivity have not been observed in this group but one child with high anxiety levels responded well to ADHD medication (*Unique*).

“ A really calm boy with very rare bad days and even then does not act out in inappropriate ways – may just get a little mouthy (sassy). Quickly apologises, can't stand to make anyone sad - 15 years

“ A fantastic, happy, comical girl who has a magnetic personality towards anyone she comes in contact with. She has many autistic traits such as arm flapping, lack of eye contact and obsessive and repetitive behaviour. She is very demanding and it feels most of the time as if we still have a 2-3 year-old. She cannot be left for a moment as she is always 'up to something' - 14 years

“ Gets along better with people who are more relaxed around him. Doesn't like loud,

“ She has made great progress with speech therapy. At two years she was saying around 40 words plus all the animal sounds and learning signs. By four years she was using gestures, pushing/ pulling and a limited vocabulary. She has a one-year delay in receptive language and more than two years in expressive language - 4 years

“ She has an excellent understanding but is unable to express herself verbally except the words bye and mine. She mostly uses gestures, noises and sign language - 2 years

noisy people with high-pitched laughs - 9 years

“Very sweet, loving, and kind. He is very empathetic and tuned into other’s feelings deeply. He always finds the positive and is very thoughtful and has taught us to ‘enjoy the day’ - 8 years

“Very impatient, will scream if not instantly accommodated. Easily frustrated and flails her arms and lashes out when she doesn’t get her way - 4 years

“Can be a little shy. Her beautiful smile is special - 2 years



“ He loves to sit and cuddle

## Health matters

### ■ Hip dysplasia

Five/ eight children have experienced problems with the development and functioning of their hip joints. One child was born with dysplasia affecting both hips: in this condition, the ball and socket hip joint has not developed perfectly. The top of the thigh (the ‘ball’) may lie outside the cup-shaped ‘socket’ in the pelvis (dislocation); the thigh bone may slip in and out (dislocatable); the hip may be in the socket but not deeply in place (subluxation); or the socket does not grow properly and is too shallow, allowing the ball to move from the right position. In this case both hips were dislocated and open reduction surgery was needed to correct the problem. Another child was born with a single dislocated hip and another with bilateral subluxation. One child developed Perthes disease, possibly caused by medication taken for an unrelated condition (see Other conditions, pages 28-9) (Hoo 1995; *Unique*).

### ■ Minor genital anomalies in boys

Minor anomalies of the genitals are more common in boys with a chromosome disorder than in those without. Two out of five boys were born with undescended testicles (cryptorchidism) and in one boy the genitals were unusually small. Treatment for undescended testicles depends on the suspected cause and is usually needed if the testicles do not descend naturally in time. The testicles can be brought down in a short operation under general anaesthetic called an orchidopexy. Another boy was born with hypospadias, where the opening usually at the end of the penis is situated on the underside. Apart from the most minor cases, hypospadias is treated using corrective surgery. An opening for the urethra is created at the tip of the penis which is

straightened if necessary. As the foreskin may be used during surgery, boys with hypospadias should not be circumcised (Miró 1980; *Unique*).

### ■ Scoliosis

Four people have been reported to have a spinal curvature. While one baby was born with a curved spine, two fused vertebrae and a missing tailbone (coccyx), the scoliosis developed in the others between the ages of four and 12. A progressive curvature can lead to problems sitting and walking and if it is severe can cause heart and lung problems. Treatment depends on the severity and progression of the curve but may involve wearing a body brace and surgery to fuse the vertebrae. In one teenager with severe scoliosis, spinal fusion was very successful (*Unique*).

### ■ Allergies

Three *Unique* families reported significant allergies in their child but it is unknown whether these are connected with the 10q duplication. One child has marked seasonal allergies; another has life-threatening food allergies and is deficient in the IgA and IgG immunoglobulins; and a third child has oral allergy syndrome, multiple drug and severe birch tree pollen allergies (*Unique*).

### ■ Heart

Most babies with a distal 10q duplication were born with a healthy heart: 3/9 are known to have been born with a heart defect. One child had a slightly enlarged aorta, monitored by a cardiologist; another was born with a hole between the two upper heart chambers (atrial septal defect, ASD) which healed naturally; a third child had a significantly decreased heart rate during rest and sleep, which did not need treatment (*Unique*).

### ■ Seizures

One child developed epilepsy at the age of 11 which was fairly well controlled with antiepileptic medication. Another child with an abnormal electroencephalogram has staring spells but has not been diagnosed with epilepsy. In a 14-year-old, seizures were quite well controlled but at less so around period time. Recently she was put on the mini-pill (progestogen only) alongside antiepileptic medication to help with hormonal changes as well as hopefully helping periods which could be very heavy and painful (*Unique*).

### ■ Kidneys

One child with a duplication between 10q25.1 and 10q26.3 has enlarged kidneys with reflux and was found to have kidneys fused together, the right kidney with two drainage tubes to the bladder (ureters). She underwent repeated operations to clear blockages from the ureters (pyeloplasty) and at four years still takes medication to normalise her blood pressure (*Unique*).

### ■ Other conditions

There are individual reports of conditions affecting people with a distal 10q duplication that may or may not be caused by the chromosome disorder. These include a child with a duplication at 10q26 who developed a type of panniculitis known as Weber Christian disease at the age of two. The disease caused the breakdown and permanent

loss of fatty tissue on the legs, parts of the arms, fingers, feet, bottom, and a little of the face. Eleven years on, the panniculitis is currently in remission but could return (*Unique*). One researcher has drawn attention to a group of six children with a duplication of at least 10q25.2qter as well as a deletion from another chromosome, all of whom have underdeveloped or missing bones (tibia, the larger bone) in the lower leg. This problem has never been observed in individuals with a pure 10q duplication (Lurie 2002).

### ■ Eyesight

Vision problems of varying severity are reported in 6/9 people with a distal 10q duplication. The most common is strabismus (a squint), looking inwards, outwards, up or down. The main effects of a squint are that the person will usually have one eye which is stronger than the other. Treatment depends on the cause but can include patching the stronger eye, exercises, glasses to correct a refractive error such as long sight and surgery to realign the muscles that hold the eye in place. Overall, strabismus is a treatable condition and vision should not be seriously affected.

Another reported difficulty is a simple astigmatism, when the cornea, the clear cover over the iris and pupil, is abnormally curved, making objects appear blurred. This is a visual problem that occurs commonly in the general population and can generally be corrected if necessary by wearing glasses.

There are also reports of babies and children with eye problems that impair vision. These include nystagmus and underdevelopment of the optic nerve that carries information from the eye to the brain affecting the ability of the brain to interpret and make sense of what the eyes see (Migliori 2002; *Unique*).

### ■ Hearing

Three young children have been reported with a conductive hearing loss (associated with the function of the outer or middle ear). A conductive hearing loss is usually temporary and due to glue ear (a build up of fluid in the middle ear). Glue ear resolves as children get older and the ear tubes widen resulting in improved drainage of the middle ear. However, while glue ear persists, many children will need grommets (small ventilation tubes) inserted into the ear drum. Alternatively, hearing aids may be used for the duration of the glue ear (*Unique*).

### ■ Happy and healthy?

There are reports in the medical literature of babies and children suffering a high rate especially of chest infections in their early years. Many will need to take asthma medications while their airways are still small but as they grow will outgrow the tendency to frequent respiratory infections (*Unique*).

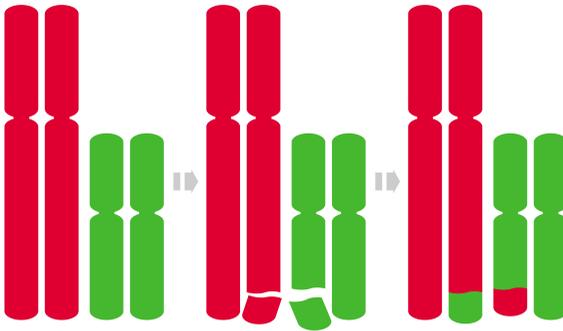
By the teen years most children need much less frequent contact with hospitals and doctors.



“ Overall a happy, healthy boy

## How did this happen?

A duplication can arise in a number of different ways. A blood test to check both parents' chromosomes is needed first. Many 10q duplications are accompanied by a loss of material from another chromosome and are the result of a rearrangement in one parent's chromosomes. This is usually a rearrangement known as a **balanced translocation** in which material has swapped places between chromosomes. As no



**A balanced translocation**

genetically relevant material has been lost or gained, the parent usually has no clinical or developmental problems, although they may have difficulties with fertility or childbearing. Balanced translocations involving one or more chromosomes are not rare: one person in 500 has one, making a total world population of over 13 million balanced translocation carriers.

Some 10q duplications occur when both parents have normal chromosomes. The term that geneticists use for this is **de novo** (dn), meaning 'new'. De novo 10q duplications are caused by a sporadic mistake that is thought to occur when the parents' sperm or egg cells are formed. The underlying mechanism is not quite clear although we know that chromosomes must break and rejoin in a complex process when egg and sperm cells are formed but this only occasionally leads to problems.

What is certain is that as a parent there is nothing you did to cause the 10q duplication and nothing you could have done to prevent it. No environmental, dietary or lifestyle factors are known to cause these chromosome changes. No one is to blame when they occur and nobody is at fault.

## Can it happen again?

The possibility of having another pregnancy with a 10q duplication depends on the parents' chromosomes. When both parents have normal chromosomes, the duplication is very unlikely to happen again in a future pregnancy.

If either parent has a chromosome change involving 10q, the possibility is greatly increased of having other affected pregnancies. If they wish, parents should have the opportunity to meet a genetic counsellor to discuss the specific recurrence risks and options for prenatal and preimplantation genetic diagnosis (PGD). PGD requires the use of in vitro fertilisation and embryo biopsy, and only healthy embryos are transferred to the mother's uterus. If the parents choose to conceive naturally, prenatal diagnosis options include chorionic villus sampling (CVS) or amniocentesis to test the baby's chromosomes. Testing is very accurate, although not all of these tests are available in all parts of the world.

## Could my child with a 10q duplication have similarly affected children?

Where the duplication is small it is possible to pass it on from parent to child. *Unique* is aware of one family where a mother passed a small microduplication on to two daughters. As advances in technology, especially the use of microarrays, uncover similar small microduplications, the possibility will increase of discovering families where a duplication has been passed from generation to generation. Theoretically, someone with the duplication would have a 50 per cent chance of passing it on and a 50 per cent chance of having a child with normal chromosomes.

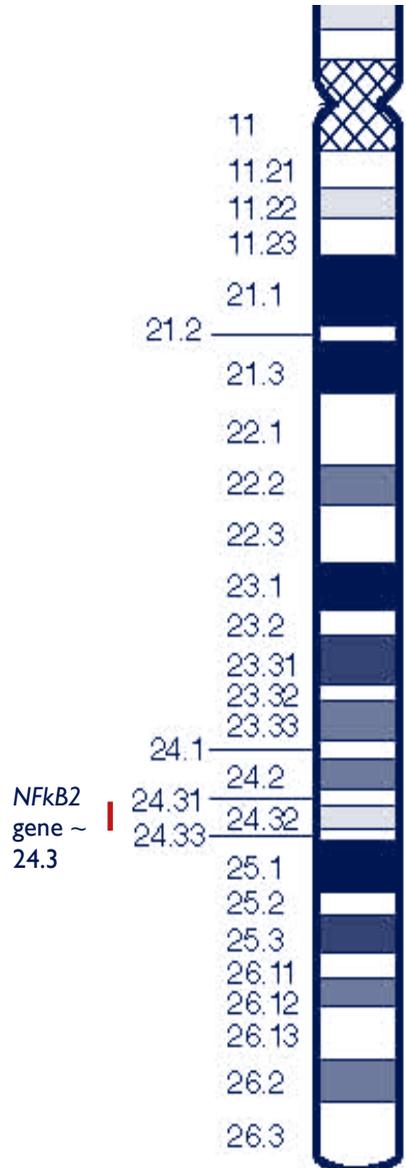
### Potential genes involved duplications of 10q

Chromosome 10 has been estimated to contain around 800-1200 genes, that is, 4-4.5 per cent of the total number of genes in the human genome. The major features of 10q duplications are likely to be caused by having an extra dose of one or more of these genes, acting singly or together.

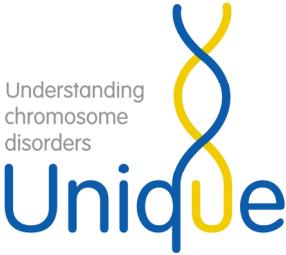
The increasing use of molecular techniques such as array-CGH and FISH in research laboratories has led to more accurate definition of breakpoints in those with a 10q duplication. This, in turn, has enabled researchers to study which parts of the chromosome correlate with the different clinical features. Indeed, a number of recent studies have tried to correlate certain clinical features in people with a 10q duplication with the extra part of the chromosome in order to help to narrow down the genes responsible.

It is important to remember that while identifying the gene(s) responsible for certain features is interesting, it does not lead directly to immediate improved treatment. Additionally, even if there is an extra dose of a supposedly responsible gene, it does not always mean that the associated feature(s) will be present. Other genetic and environmental factors often have a role in determining the presence or absence of a particular feature.

The *NFkB2* (nuclear factor kappa-B) gene at 10q24 has been proposed as a candidate gene for pyelectasis (dilation of the part of the kidney that collects urine). When three copies of the gene are present instead of the normal two, it's suggested that the kidneys undergo enlargement (hydronephrosis) following obstruction of the ureteropelvic junction (Chen 2008).



## Support and Information



### Rare Chromosome Disorder Support Group,

G1, The Stables, Station Road West, Oxted, Surrey RH8 9EE, United Kingdom

Tel/Fax: +44(0)1883 723356

[info@rarechromo.org](mailto:info@rarechromo.org) | [www.rarechromo.org](http://www.rarechromo.org)

Join Unique for family links, information and support.

Unique is a charity without government funding, existing entirely on donations and grants. If you can, please make a donation via our website at [www.rarechromo.org](http://www.rarechromo.org) Please help us to help you!

There is a families' website for distal trisomy 10q at  
<http://trisomy10q.org>      [info@trisomy10q.org](mailto:info@trisomy10q.org)

Unique lists external message boards and websites in order to be helpful to families looking for information and support. This does not imply that we endorse their content or have any responsibility for it.

This information guide is not a substitute for personal medical advice. Families should consult a medically 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. It was compiled by Unique and reviewed by Professor Jean-Pierre Fryns, Department of Human Genetics, Catholic University of Leuven, Belgium and by Unique's chief medical advisor, Professor Maj Hultén BSc PhD MD FRCPath, Professor of Reproductive Genetics, University of Warwick, UK. 2009. V1.1 (PM)

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