CASE REPORT

Oral health management of a patient with 47,XYY syndrome

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SUMMARY

The 47,XYY syndrome is an aneuploidy (abnormal number) of sex chromosomes, where a human male receives an extra Y chromosome, making 47 chromosomes instead of the usual 46. Individuals with 47,XYY are usually physically normal and tend to be tall and thin. They are not at increased risk of mental retardation and cardiovascular diseases. They may have speech delay, hyperactivity and normal/decreased IQ level. Behavioural problems are not common in 47,XYY individuals. There have been reports that suggest the tooth-size increase in 47,XYY males is due to a direct genetic effect. The patient presented with multiple over-retained deciduous, unerupted permanent teeth and increased incidence of carious lesions may be attributed to decreased oral hygiene maintenance. The present article describes the medical and dental history along with the clinical management of oral health issues in an 18-year-old male patient with 47,XYY syndrome having normal physical structure and development.

BACKGROUND

The 47,XYY syndrome is a chromosomal aberration of the sex chromosomes in which men receive an extra Y chromosome. This condition is found in 1 of 1000 male live births.¹ 47,XYY men appear to be physically normal, usually tall and thin, with normal gonadal function.²⁻³

The 47,XYY sex chromosome abnormality has been described since the first description of a group of men with 47,XYY in 1965 by Jacobs *et al*,⁴ who conducted a chromosome survey of male patients. The 47,XYY syndrome is characterised by tall stature as well as neurological, cognitive and behavioural phenotypes.⁵⁻⁶ Jacobs *et al*,⁴ described XYY individuals as fully developed, fertile males having normal faces, genitalia, mental ability and muscle tone. Nevertheless, 47,XYY boys have an increased growth rate during early childhood with tall stature, mild learning disabilities and delayed speech and language skills.⁷⁻⁸ It was once believed that XYY syndrome caused irrational, aggressive and criminal behaviour.⁹

According to Alvesalo,¹⁰ there is increasing evidence favouring genetic causes that X and Y chromosomes carry genes that influence tooth size in normal males and females. The results of studies¹¹⁻¹² on permanent and/or deciduous teeth in 47,XYY males demonstrated that teeth were larger than control males due to the effect of abnormal sex chromosome constitution or sexual differentiation on tooth size.

Until now, little is known regarding phenotypic changes in the head and neck and clinicopathological findings in 47,XYY syndrome. Therefore, we present a case report of an 18-year-old male patient with 47,XYY syndrome who was attended to for aesthetic concerns regarding his teeth.

CASE PRESENTATION

An 18-year-old male student was referred to the clinic of Special Care Dentistry, College of Dentistry, King Saud University in May 2012. The patient desired to have better aesthetics as he was being bullied at his school for his malposed teeth. The patient has been visiting the outpatient clinics at the College of Dentistry since 1999 when he was 5 years old. He has been followed up over the years for his genetic condition that was diagnosed as 47,XYY syndrome.

The patient had numerous missing/unerupted permanent teeth and many over-retained deciduous teeth at the time of the initial visit. He was accompanied by his father. He has undergone various dental procedures including extractions, temporary and permanent restorations and removable partial denture in the past. The patient is followed up and is on regular treatment at the King Khalid University Hospital (KKUH) for some systemic conditions, which are as follows:

- ▶ Right bundle branch block shown on ECG with sinus venosus changes for suspected atrial septal defect (ASD) in 1999. However, later in 2003, the echocardiography report showed normal results;
- ▶ Bronchial asthma for which he is at present, occasionally, using a bronchodilator inhaler (Ventolin);
- ▶ General health condition related to 47,XYY syndrome.

Extraoral examination showed some dysmorphic features such as hypertelorism, depressed nasal bridge, epicanthal folds and low-set small ears with underdeveloped pinnae. Maxilla showed hypoplasia (figures 1 and 2).

Intraoral examination of oral tissues revealed macroglossia with a protrusion of lower anterior teeth. There was a skeletal class III relationship of the jaws.

- ▶ The status of the dentition was as follows:
- ▶ 16, 55, 54, 53, 12, 21, 22, 63, 65 and 26 in the upper arch,
- ▶ 46, 85, 44, 83, 41, 31, 73, 34 and 75 in the lower arch.
- ▶ There were no supernumerary teeth found during the oral examination or on any

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Figure 1 Extraoral photograph of the patient showing hypertelorism.

radiographic evidence; although, it was difficult to make out the precise tooth numbering as there were many over-retained deciduous teeth, unerupted permanent teeth and some transposed teeth (as seen in the radiograph) overlapping other teeth.

- Both the lateral incisors were peg shaped, although the left upper lateral incisor was upright in position. The upper right lateral incisor was in a labioversion and discoloured as a whole with carious lesion on the mesial aspect. The patient's

Figure 2 Lateral view showing maxillary hypoplasia and mandibular prognathism along with prominent nose, frontal area.

Figure 3 Intraoral photograph showing dental status with carious and retained deciduous and peg-shaped lateral incisor.

oral hygiene was not satisfactory with the presence of multiple carious teeth (figure 3).

- The teeth which were carious—54, 12, 21, 63, 26, 31, 41 and 46.
- The patient was using an old worn out partial denture that attained poor aesthetics, poor fit and resultant caries apparently from plaque accumulation.

INVESTIGATIONS

The diagnosis of 47,XXX syndrome was established in August 1999 using high-resolution chromosomal analysis at KKH. A CT scan of the brain and abdominal ultrasound were normal. His IQ was assessed to be 91 at KKH in the year 2000 using Wechsler Intelligence Scale for Children method. The parents were counselled about the syndrome's natural course, prognosis and risk.

Dental radiographical evidence showed eruption of lower right second premolar resorbing the distal root of the lower right primary second molar. Other radiographical evidence showed multiple retained primary teeth and non-erupted permanent teeth (figure 4). The patient additionally had a skeletal class III relationship (figure 5).

The patient was not keeping well during early childhood due to asthma and suspected ASD. Hence, he was hospitalised in early 1999 due to severe asthma, and all examinations were carried out. Since the patient was admitted in KKH, which is a tertiary hospital, a genetic analysis was also conducted by high-chromosomal analysis and the diagnosis of 47,XXX syndrome was given.

Figure 4 Panoramic radiograph showing multiple over-retained deciduous and unerupted permanent teeth (taken at the initial visit).

Figure 5 Lateral cephalogram showing skeletal class III relationship.

TREATMENT

It was discussed with the patient and his father for any suggestions, and a treatment plan was accordingly put forward:

- ▶ Facilitating the eruption of permanent teeth by extraction of the retained primary teeth;
- ▶ Distalization of the lower left first premolar to provide more space for the eruption of lower anterior segment;
- ▶ Disimpaction of impacted teeth by orthodontic traction through the use of upper mini-implants;
- ▶ Upper transpalatal arch and lingual holding arch to anchor the disimpaction of the anterior teeth;
- ▶ Levelling and alignment, to allow for space creation and final occlusal detailing.

The patient agreed to the treatment plan but as the case was complex, it would take a long period for the orthodontic treatment; henceforth, an intermediate treatment plan was developed first to address the aesthetic concerns of the patient.

At the time of the initial visit it was determined that the prognosis for the upper right peg lateral for alignment was not favourable, moreover it was carious and the patient's main concern regarding his aesthetics was this tooth. (figure 3) It was decided that the retained primary mandibular second molar as well as the maxillary right peg lateral teeth would be extracted at the next visit.

OUTCOME AND FOLLOW-UP

In the course of treatment, the other teeth that were also extracted were the upper right deciduous canine, upper right deciduous first and second molars. Upper left deciduous canine and lower canines were later on extracted. These extractions were carried out to aid the eruption of the underlying permanent teeth. However, maxillary and mandibular primary second molars on the left side were retained to aid the stability of the occlusion as both the permanent molars as well as the second premolar in the mandibular left side were impacted (figure 6).

It is noteworthy that the patient had in the past received antibiotic prophylaxis for dental treatment due to his cardiac

Figure 6 Photograph showing extracted peg-shaped permanent right maxillary lateral incisor and right primary mandibular second molar with caries.

condition. All procedures were performed without any antibiotic prophylaxis as per the National Institute of Health and Care Excellence 2008 guidelines.¹³ All carious teeth were initially stabilised, and later on fixed partial denture was constructed in the lower anterior region on either side of the central incisors. For maxillary teeth, an over denture was constructed after restoring the upper left central incisor and extraction of primary teeth except the left second primary molar that had a stainless crown. This was performed to aid in the retention of the over denture (figure 7).

After the extraction of 85 there has been complete eruption of 45, no other permanent tooth has shown eruption in place of the extracted deciduous tooth (figure 8).

DISCUSSION

The 47,XYY syndrome is a sex chromosomal abnormality that typically involves the presence of an extra Y chromosome and was first reported in 1961 by Sandberg *et al.*^{14 15} This syndrome is not usually detected in either childhood or adulthood unless there is some medical reason for a karyotype to be constructed for the individual.¹⁴

The clinical features of 47,XYY are subtle and can be variable. Individuals with 47,XYY are usually physically normal as infants.¹⁶ Individuals with 47,XYY are believed to have a normal life span.¹⁷ By definition, 47,XYY occurs exclusively among males. However, individuals with 47,XYY and female phenotype have been reported.¹⁸ There are three plausible

Figure 7 Post-treatment photograph with improved dental aesthetics.

Figure 8 Intraoral photograph showing dental status with eruption of 45 after the extraction of 85 (compare with figure 3).

mechanisms by which an extra Y chromosome is formed: (1) non-disjunction at male meiosis II (MII) following a normal chiasmate meiosis I (MI) in which recombination occurs between the X and Y chromosomes within the Xp/Yp pseudoautosomal region (MII-C); (2) non-disjunction at male MII following an MI in which recombination between the X and Y chromosomes does not occur (MII-NC) or (3) postzygotic mitotic non-disjunction.¹⁹ In this case, the diagnosis was made through high-chromosomal analysis when the patient was 5 years old.

Early studies of 47,XXX males suggested that they were 10 times more likely than normal men to be found in criminal populations. Many studies have revealed the association between 47,XXX and criminality with the varying incidence ranging between 0% and 2%. An early study by Witkin *et al*,⁹ put these thoughts into perspective.

Recent findings on autistic features in XXX phenotype by Lee *et al*⁸ shed a new light, suggesting that a tendency to get in trouble with the law may be related to deficits in social communication and interpersonal skills, rather than unnatural levels of aggression. Later, Jacobs *et al*⁴ found an increased prevalence of this syndrome in males having substandard IQ and aggressive predilection. They described XXX individuals as fully developed, fertile males having normal faces, genitalia, mental ability and muscle tone. The IQ of 91, in this case, however, points towards an average IQ. Although the patient was going to school, yet his credentials as described by his father were not great.

At the initial visit, the patient seemed to show some aggressive behaviour and at times was easily upset during the treatment periods. However, by time and especially with the aesthetic improvement the patient showed a better and friendlier attitude. Nothing was apparent with the patient that might have advocated towards a criminal behaviour.

To date, few reports are documented regarding the clinical phenotype of individuals with 47,XXX syndrome, except tall stature, possibly due to the overexpression of growth-related short stature homeobox gene on the X and Y chromosomes.^{7 20} The patient was 177 cm tall, which can be classified as a tall individual at his age and race. The patient has a total of five siblings of which four of them are boys and one is a girl. He is the fourth child and all his elder brothers have a height range 162–164 cm; his sister is 22 years old with a height of 154 cm. One younger brother (youngest of all) is 12 years old with a height of 124 cm.

A recent study showed that all boys with 47,XXX syndrome were normal in appearance with specific facial phenotype

involving the ocular and malar region. They also noted mild hypertelorism, broad nasal bridge, low-set ears and mild flat malar region²¹ coinciding with the present findings. However, certain dysmorphic features were also observed in the present case such as hypertelorism, depressed nasal bridge, epicanthal folds and low-set small ears with underdeveloped pinnae. The maxilla appeared hypoplastic (figure 1).

Only few studies on tooth size have demonstrated that both deciduous and permanent teeth are somewhat larger in boys with 47,XXX than other boys and the teeth have longer roots.^{11 12} In this case, we found nothing to suggest that the size of the extracted deciduous teeth or the permanent teeth as seen in the radiographs are larger than the normal average.

Results of recent studies have shown increased root length in 47,XXX males in contrast to normal males.^{22 23} The root lengths of the posterior mandibular teeth on the left side seemed to be longer and well below the level of the mandibular canal as observed in the panoramic radiograph (figure 4). Nevertheless, earlier results have shown an increase in tooth crown and root growth in 47,XXX males and 46,XY females suggesting a role of genes promoting tooth formation, located on the sex chromosomes.²³

Learning points

- ▶ The clinical features of 47,XXX are subtle and can be variable. Individuals with 47,XXX are usually physically normal and tend to be tall and thin.
- ▶ They are not at increased risk of mental retardation and cardiovascular diseases. They may have speech delay, hyperactivity and normal/decreased IQ level. Behavioural problems are not common in 47,XXX individuals.
- ▶ This article reports a case of 47,XXX syndrome with normal IQ and general behaviour.
- ▶ Our patient was presented with few abnormal phenotypical and clinicopathological features other than multiple over-retained deciduous and unerupted permanent teeth.
- ▶ Increased incidence of carious lesions may be attributed to decreased oral hygiene maintenance.

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