KLINEFELTER SYNDROME: CASE REPORT

F. CAPASSO, F. PANETTA, G. IERARDO, V. PARISELLA, A. POLIMENI

University Sapienza of Rome, Italy, Department of Pediatric Dentistry

SUMMARY

Klinefelter syndrome: Case report

Objectives. The aim of this work is to describe the problems of child dentistry affected by Klinefelter's syndrome.

Methodos. Through the presentation of a clinical case that was followed by a Pediatric Dentistry, University Sapienza of Rome.

Result. Interceptive therapy aims to eliminate the functional interference that occurs during growth.

Conclusion. For this reason it's a must for the dentist to carefully monitor the oral health of the small patient immediately.

Key words: Klinefelter syndrome, chromosomal abnormality, oral aspects.

RIASSUNTO

La Sindrome di Klinefelter: case report

Obiettivo. Lo scopo del seguente lavoro è quello di descrivere le problematiche odontostomatologiche del bambino affetto dalla sindrome di Klinefelter.

Metodo. Attuato attraverso la presentazione di un caso clinico giunto all'osservazione del Dipartimento di Scienze Odontostomatologiche UOC odontoiatria pediatrica.

Risultati. Scaturiscono dall'intercettazione e risoluzione delle problematiche scheletriche e funzionali con dispositivi ortodontici.

Conclusioni. Evidenziano l'importanza dell'intercettazione precoce e la collaborazione tra pediatra ed odontoiatra.

Parole chiave: Sindrome di Klinefelter, alterazione cromosomica, aspetti odontostomatologici.

Introduction

Klinefelter Syndrome is a chromosomal abnormality characterized in 80% of cases by a set of chromosomes 47 XXY and 20% from XXXY karyotype, xxyy or frameworks such as mosaicism 47XXY/46XX, 47XXY/46XY, etc.; Despite chromosome damage, in a female genotype, the Y chromosome would prevail, leading to the male phenotype. The chromosomal aberrations result from a not meiotic disjunction of chromosome X in the gametogenesis of the parents or from a not mitotic disjunction in the zygote. The classic shape is owing to not meiotic disjunction of chromosomes during gametogenesis. Some 40% of these changes occur during oogenesis and one of the predisposing factors is the advanced age of the mother. The form of mosaic is probably the consequence of the non-mitotic division of chromosomes after fertilization of the zygote and can occur in a zygote 46, XY, and in a zygote 47, XXY. This syndrome is a chromosomal-sexual disorder most common with an rate of 1 in 500 males, with prevalence of any ethnic group and is characterized by significant testicular dysfunction, azoospermia, gynecomastia, decreased libido, increased plasma gonadotropins in males with two or more chromosome X. The diagnosis is often delayed because of various clinical forms with which the syndrome presents itself during childhood, the common feature of the disease include a delayed development of speech, difficulties in school, while in the prepubertal period, patients appear normal, except for testicular hypoplasia and an increase in height caused by an abnormal growth of long bones. After puberty, the disease is manifested by infertility, gynecomastia, which is sometimes inadequate or eunucoide masculinization owing to the lack of androgens.

The most characteristic aspect of the variety 47, is the ialinizzation of seminiferous tubules and azoospermia, XXY. The gynecomastia usually occurs during adolescence and is predominantly bilateral and painless and can be disfiguring. In about one third or half of the cases, there commences to appear obesity and venous varicosities. The risk of breast cancer is 20 times higher compared to healthy males. Most patients manifest a heterosexual behavior and a normal sexual function (1). Usually form with mosaicism is less severe variant of the classical (47, XXY) and the testes may be of normal size.
Usually there are high levels of plasma FSH and LH and as a result there is severe damage to the seminiferous tubules. The dosage of FSH is particularly discriminating for the diagnosis, given the lack of overlap with healthy subjects. Testosterone plasma presents concentrations that are present in about half of normal cases, but its range overlaps extensively to normal range. The remains included are because of the high average values of estradiol plasma. The testicles may secrete in the early stages of the disease resulting in large amounts of estradiol in response to increasing concentrations of plasma LH, but the testicular secretion of estradiol (or testosterone) may possibly decrease. Subsequently raising of estradiol plasma may, however, probably be attributed to the combination of reduced metabolic clearance and an increased conversion of testosterone into estradiol by extra tissues of ghiandular. In both cases, this entails an insufficient masculinization and feminization of varying degrees. The feminization, including gynecomastia, depends on the relationship between estrogen and androgen in circulation (relative or absolute): in fact, subjects with low plasma levels of testosterone and high levels of estradiol, most often develop gynecomastia. After the age of puberty, there is an abnormal present of activity in the plasma gonadotropins to the administration of LHRH and a defect in the negative feedbeck of testosterone on the secretion of pituitary LH. Patients with Klinefelter's syndrome. If not treated, it may become a"reactive pituitary abnormalities that occur with an enlargement of the saddle turcica, probably secondary to the absence of persistent gonadal feeedback and hypertrophy of gonadotrope cells in response to stimulation with LHRH. In literature there aren't studies that significantly link syndrome with the greatest frequency of occurrence of pituitary adenomas (2, 3).

Oral aspects of Klinefelter's syndrome

Some specific procedures in patients with syndrome of K. have been identified from a comprehensive review of the literature, concerning the growth of the strull apparat, occlusion, the teeth and the periodontium.
1) The facial morphology of individuals with Klinefelter syndrome has been described by Gorlin et al. (1965), which have focused upon the palate and mandibular prognathism. A cephalometric study on 36 danish adult patients suffering from Klinefelter's syndrome was made by Ingerslev and Kreiborg (1978). A comparison with 102 normal adults, subjects with Klinefelter's syndrome show many distinctive characteristics, namely an increased flexion of the cranial base, a greater goniale angle and a pronounced jaw and mandibular prognathism. The Authors suggest that the increased prognathism in patients with Klinefelter's syndrome, is due to the shape of the base of the skull. The cephalometric of 22 adult males with Klinefelter syndrome was compared with those of 29 normal adult male subjects and 49 normal adult females. It was noted in patients with Klinefelter syndrome, that a decrease of length in the anterior cranial base, the height facial and mandibular branch. The Authors suggest, in this case, that the supernumerary X chromosome, affects the normal development of craniofacial growth. In any case, each linear measure, excluding the length of the mandibular branch, is greater in the group with Klinefelter syndrome, compared with normal adult subjects (4).
2) The dimensions of dental crowns, characteristics of the syndrome and other sex chromosome aneuploidies, were analyzed by Alvesalo (1985) and Townsend et al. (1988). For example, in patients with Turner syndrome is characterized by a reduction of the mesial-distal diameter and the vestibule-oral teeth, respectively 6.1% and 2.6%, while in male patients

with Klinefelter syndrome shows that an increase of 1.8% and 1.7% of these diameters. This was directly related to effect of X and Y chromosomes on tooth development. The size of the circles resulting from the increased presence of the additional X or Y chromosomes, is resulted by the loss of these chromosomes. It is also for the comparative thickness of enamel and dentin, where the X chromosome affects mainly the thickness of the enamel, while the Y chromosome promotes both the deposition of enamel than dentine. It 's clear that the measures the thickness of the enamel and dentin affect the size of the dental elements (5, 6).

The measurements were made on both sides of an ark, but no differences were found related to the side under examination and hence in the absence of an element, it is used indiscriminately to the extent of its contralateral. The differences were not uniform: the mesial-distal diameter and oral vestibule of the first-molar, which is higher than lower, have significantly increased in patients with Klinefelter's syndrome, while no differences were found in the size of canines (7).

3) The growth is influenced by height syndrome: Sorensen (8) observed that 5 children with Klinefelter syndrome, observed aged 3 to 10 years, were approximately 5 cm higher than normal children of the same age. The increase in height showed that the length of the leg was predominant than a length of the trunk (9)

It was the study of Finnish workers that little is known of the craniofacial characteristics of males with Klinefelter syndrome than the normal population, or of the morphological relations between patients and healthy members of their families. The initial number of patients with Klinefelter syndrome was increased by a certain number of first-degree relatives including parents, brothers and sisters but only for adults (3).

The cephalometric analisys of 40 subjects with Klinefelter syndrome, with an age range from 5 to 58 years, were selected. The cephalometric control over healthy relatives involved 33 subjects (6 fathers, 11 brothers, 10 sisters and 6 mothers). 26 Radiograms represented the sample Klinefelter men from 18 to 58 years, to examine the representative measurements of the syndrome. The X-ray included 7 fathers and 8 brothers from 18 to 67 years. The female were in charge of involving 6 mothers and 8 sisters from 26 to 51 years of the same X-Ray (10).

The main system of cephalometric analysis is the Pattern Profile Analysis (PPA) described by Garn et al. (11), which is the method that requires the measurement of 16 linear distances that are at the base of the skull, the height and width of face, the facial profile, size and angle of the jaw.

As a result, there is an increase in linear dimensions in patients with Klinefelter syndrome than in the group of women in which are dominant, of which only 2 are negligible. Apart from the mandibular prognathism, which is significantly more pronounced in subjects suffering from the syndrome, there are few contrasts in facial form between these and the dominant group of women (12).

Compared to the dominant males, subjects with Klinefelter syndrome have more similarities with the majority of individuals in the dominant group. The most important difference is in the jaw line which is large, but much smaller in size of the branch. Other measures are lower in subjects with Klinefelter syndrome, but these differences are not statistically significant.

The analysis shows us that subjects with Klinefelter syndrome are more prominent in the facial profile relatively to the base of the skull, in the dominant groups of both male and female.

It is interesting to note that the pattern of Craniofacial Finnish males with Klinefelter syndrome are similar to that described in the Danish group by Ingerslev and Kreiborg (13).

The dimensions of the palate in males with Klinefelter syndrome, compared with their first-degree relatives and the dominant population, have no discrepancies with regards to the depth of the palate, although there is an increase of the transverse diameters of the maxilla (Tab. 1).

4) A study conducted by Tuija Palin-Palokas et al. (1990) demonstrated the greater prevalence of caries in patients with Klinefelter syndrome than their male relatives of the first degree. The study is part of a comprehensive research project to assess the growth and the health of oral facial in subjects with sex chromosome aberrations. The study includes 45 males with Klinefelter syndrome (47, XXY) and 14 of their

Table 1 - Dimension (mm) heigher in the arc alveolar males with Klinefelter syndrome (A), male relatives of First istance (B) and popular control (C).

Palato height at the level of dental items	(A) x	(A) SD	(B) x	(B) SD	(C) x	(C) SD
Canine	3.3	1.2	3.0	1.4	2.4	1.2
First premolar	8.7	1.8	8.5	1.8	8.4	2.1
Second premolar	13.3	2.6	13.5	2.2	14.3	2.1
First molar	15.2	3.3	14.9	2.1	16.4	2.2
Large of the palate at the level of dental elements	(A) x	(A) SD	(B) x	(B) SD	(C) x	(C) SD
Canine	28.6	2.1	25.1	1.3	26.1	2.0
First premolar	31.0	2.3	28.5	1.7	29.2	2.5
Second premolar	34.7	2.5	33.3	2.1	33.6	3.6
First molar	36.7	2.3	34.5	2.0	35.8	3.1
Length of the palate at the level of dental elements	(A) x	(A) SD	(B) x	(B) SD	(C) x	(C) SD
Canine	8.4	1.6	8.1	1.5	6.0	1.2
First premolar	14.4	2.0	13.8	2.0	11.3	1.5
Second premolar	20.7	3.2	20.4	2.1	18.0	2.0
Ferst molar	28.1	3.6	29.1	2.0	25.2	2.2

brothers, the average age of the first group is 31.9 years, the second is 36.8. The brothers were chosen as the dominant ones to have 2 groups as homogeneous as possible in relation to family activities, educational level and degree of employment (14).

The diagnosis of caries was both clinical and, at a radiological level. The presence of caries was expressed in terms of DFS (decayed or filled tooth surfaces), calculated by the risky areas of their permanent teeth and DMFS (decayed tooth surfaces, missing due to caries or filled).

No one of any of the two groups showed any sign of the caries. The front elements (incisors and canines) were free of caries in '11% of subjects with the Klinefelter syndrome, and in 12% of their brothers. In the first group, the values of DMFS and DFS for areas at risk in both the elements of anterior-lateral and posterior (premolars and molars) were higher.

The number of elements extracted on age, was twice in the first group than the latter (15) (Tables 2, 3). The differences observed in the two groups are significant: the incidence of caries was 1.5 times higher in subjects 47, XXY compared with siblings, particularly with regard to the rear elements.

The number of extracted teeth is greater in subjects 47, XXY, reaching twice the number in the both dominant groups (16).

Individuals with Klinefelter syndrome take medicines (such as tranquilizers), more frequently than healthier subjects. These drugs can cause a decrease in the amount of saliva secreted, which in turn promotes the onset of caries. Since the production of certain antibodies (IgA) is controlled by certain genes on chromosomes X; the specific mechanisms of defense of saliva may be altered in this case.

5) There are few studies on the periodontium, Rusu et al. (1970), for example, Rusu reports that the presence of lesions periodontium resulting from genetic and neuroendocrine factors. Burcoveanu and Gavrilicta (1978) reported a chronic marginal periodontium (in 7 cases it is superficial and severe in 11) in all 18 patients with Klinefelter syndrome they observed (17).

A study of Pertti Vaisanen et al. (1985) evaluated the periodontium health of permanent teeth in a group of males with Klinefelter syndrome (47, XXY), compared with healthy siblings of the same brothers. The group is made up of 37 subjects (47, XXY), 12 of which have a brother (the dominant group is made

Table 2 - Contents DMFS end number of theeth e xtracted, according to age, in subjects with Klineferter sindrome (47,XXY) and their brothers.

	47, XXY		Brothers	
DMFS total	74.2	3.5	52.2	6.3
DMFS in the front teeth (incisors and canines)	21.4	1.9	12.8	3.3
DMFS in posteriors teeth posterior (premolar and molar)	52.8	1.9	39.5	3.5
Estracted teeth	10.2	1.1	5.3	2.0

Table 3 - DFS index calculated for areas at risk in patients with Klinefelter sindrome (47,XXY) and their brothers.

	47, XXY		Brothers	
DFS on the areas at risk of front teeth	0.21	0.04	0.17	0.04
DFS on the areas at risk of posterior teeth	0.62	0.06	0.46	0.06

up of these 12 siblings), and the one nearest to the subject of 47,XXY would be selected.
The gingival inflammation was measured by the gingival index (GI, Loe and Silness, 1963) and the presence of tartar above and below the gum was evaluated during the clinical examination of all tooth surfaces (IT). The number of tooth surfaces showed that bleeding was measured using the Gingival Bleeding Index, or GBI, with GI values of 2 or 3 with the presence of plaque (plaque index, CI). The tooth mobility was graded on a scale from 0 to 3 (0 = fixed teeth, 1 = horizontal tooth mobility equal to 1 mm, 2 = horizontal tooth mobility of more than 1 mm, 3 = vertical mobility). The results are expressed according to the indices GI, GBI and CI (18) (6).
The number of teeth present was lower in group 47, XXY; no person with 47, XXY and no brother of 47,XXY, was devoid of gingivitis. The values of GI, GBI and CI were significantly higher in the group under consideration, relative to that of the dominant group. There was no negligible difference compared to the index of tooth mobility (Tab. 4).
This study shows that the periodontium of a subject with Klinefelter's syndrome is more prone to inflammation than a healthier person. Again, the treatment of these patients (systemic hormone therapy) increased the sensitivity of gingival, favoring the decaying of conditions of periodontium. Patients who are in hormonal imbalance, such as puberty, pregnancy, or menopause, are confirmed by the inflammation and gum disease of periodontium. It is also important to take into account that often these individuals are in a situation of poor oral hygiene or who are mentally compromised, or don't listen to health department. It 's clear that a reduction in salivary secretion is associated with an increased risk of disease parodontium, and the drug therapy to reduce the salivary secretion is submitted to these patients (19) (Tab. 5).

Case report

History

It was presented and observed by the the Department of Pediatric Dentistry of the University " Sapienza" of Rome, the patient SM of 7 years, suffering from Klinefelter's syndrome (XXXY).
The subject makes his first dental visit, sent by the

Table 4 - Values of GBI, GI, e CI in subjcts with Klinefelter syndrome than in the controll group.

INDICES	47,XXY	Controll groups
G.I.	1.4	0.3
G.B.I.	27.7	16.8
C.I.	30	19.3

Table 5 - Oral aspects of the K. syndrome.

Increased mandibular body
Mandibular branch reduced
Reduced anterior cranial base
Palatal depth reduced
Increased transverse diameters exceeding
Reduced transverse diameters below
Prognathism
Reduced jaw length
Tendency to a Class III molar
Increase in mesial-distal diameter and vestibule-oral dental
Taurodontismo
Dental agenesis
Enamel hypoplasia
Increased susceptibility to dental caries (poor oral hygiene due to mental deficiency, xerostomia drug, hormonal imbalance, and hormonal therapy)
Gingivitis
Chronic marginal parodontium (from hormonal imbalance and immune deficiency)

pediatrician. The history reported by the parents that the children have a number of food intolerances (milk, apple and egg), and an allergy to certain antibiotics; up to 2 years the patient has suffered from convulsion, and is currently sightseeing in the pharmacological treatment with anxiolytic. These are obvious language disorders, mentally delayed and are delayed by a non serious psychomotor.
From physiological history results show that the mother, during pregnancy has not been in good health: the threat of abortion is at 2 months and at 6 months it was noted that the fetus grew retarded. The placenta was aging, hence the birth was carried out at 42 weeks; during the physiologic birth, there occurred a neonatal asphyxia and pneumothorax.
In the first year of life it was revealed that psychomotor retardation, which is difficulty in feeding (feeding was artificial) and seizures until the age of 2 years when you made the diagnosis of Klinefelter's syndrome in XXXY karyotype. Psychomotor disturbance is the cause of frequent accidental falls of the subject, one of which dates back to 2 years before the visit, with a nose-jaw contusion and suspected fracture.

Extraoral examination

The facial type is clearly short faced, with convex profile (Figg. 1 and 2). Facial symmetry is respected, and the chewing muscles is normotrophic, the lips are competent (Figg. 1, 2)

Intraoral examination

The subject presents open bite, probably due to habit of sucking flawed finger, the maxilla shows hyperplasia with presence of bilateral scissor bite (Fig. 3-8). Alteration of masticatory function, frequent intake of nutrients through the bottle, gastro-intestinal disorders (Figg. 3-8)
The overjet is normal; the over bite is 8mm; the molar ratio is first class as bilaterally; it has a late exchange of elements from dental, showing the dental skema in Table 1 (Tab. 6).
The size, shape and position of the tongue is normal, as well as pull, gums and periodontium; oral hygiene is good, and shows there are no more caries. Also we find an uncharacteristic of swallowing. The OPT examination reveals that the presence of all elements in permanent eruption or tooth bud stage; a normal timing of exchange of the elements themselves; the absence of newly-formed pathologies (cystic) in the jaw; the absence of injury or caries periodontium (Fig. 11). The cephalometric analysis revealed: Class II skeletal maxillary protrusion from; protrusion maxillo-mandibular; normal divergence, growth neutral maxillary plane route counter-clockwise, the lips tilted lower incisor forming a convex profile (Fig. 12) (Tab. 7).

Therapy

Interceptive therapy aims to eliminate the functional interference that occurs during growth.
First it has been an upper horizontal grid (Fig. 9) welded to bands to counter the habit of finger sucking. More importantly its the motivation of the child and the involvement of their parents to find and eliminate the causes of suction, often linked to emotional deficiencies or psychological stressful situations. It was then applied as an orthodontic BIELIX with the grid (Fig. 10), to counter the interposition lingual and promote the expansion below the arch. This has now commenced very simple exercises in tongue rehabilitation. (Fig. 8-9-10-11-12.)

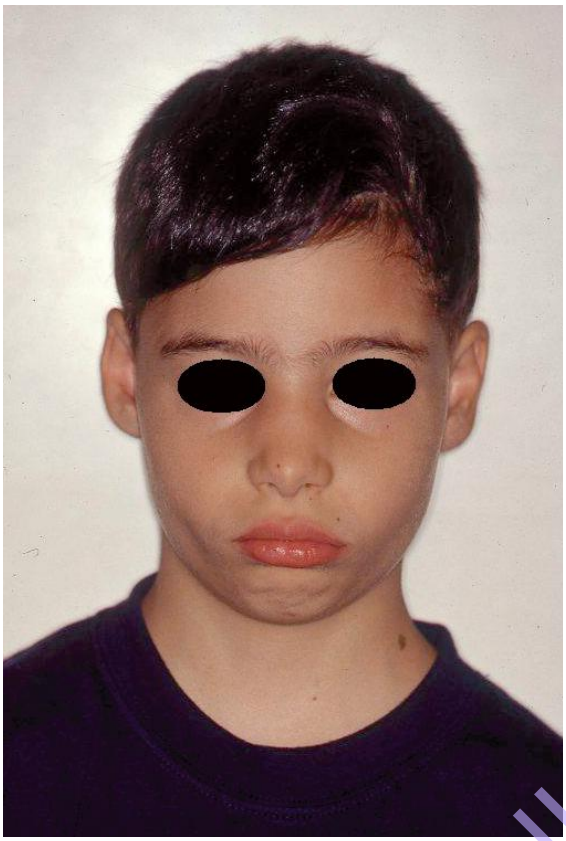

Figure 1
Pretratment extraoral frontal photo.

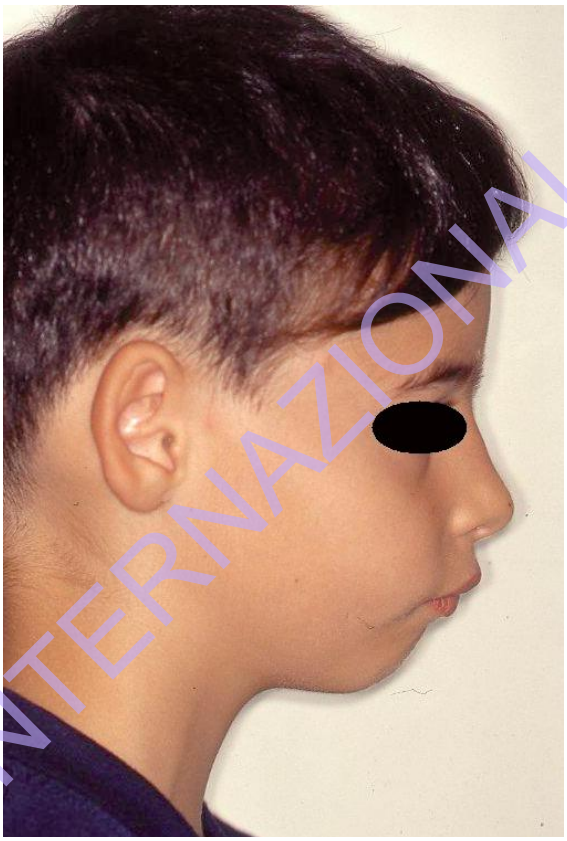

Figure 2
Pretratment extraoral lateral photo.

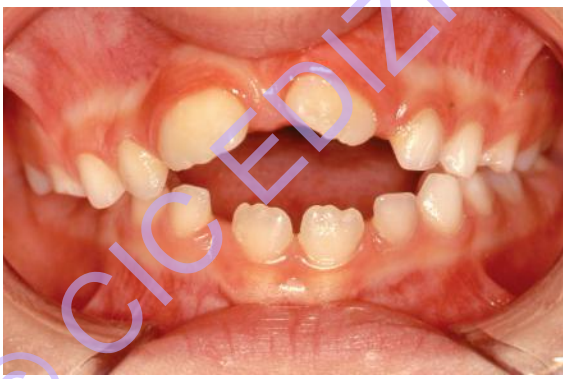

Figure 3
Pretratment intraoral frontal view.

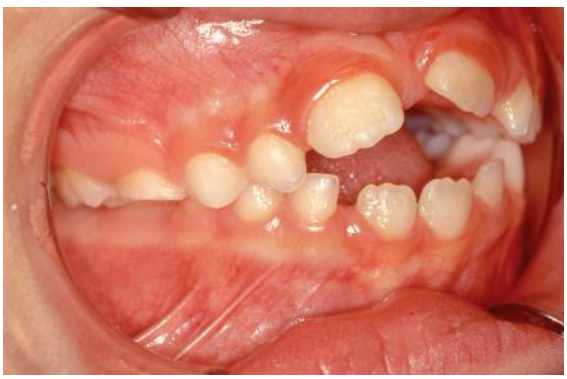

Figure 4
Pretratment rigth lateral occlusion.

Conclusion

The clinical case fortunately presents no details of the compromises stomatognatic has, but the clinical picture is often found in healthy children.
Precisely for this reason it's a must for the dentist to carefully monitor the oral health of the small patient immediately, to intercept any orthodontic and dental problems before they evolve.

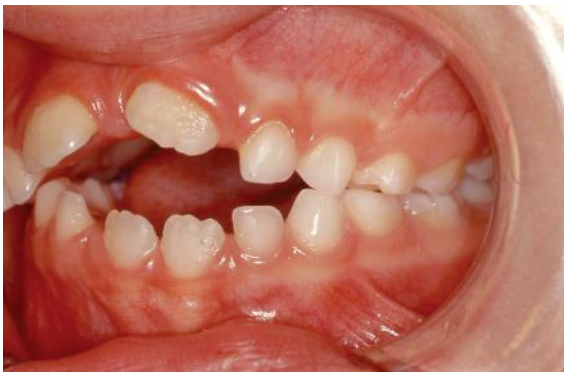

Figure 5
Pretratment lateral left occlusion.

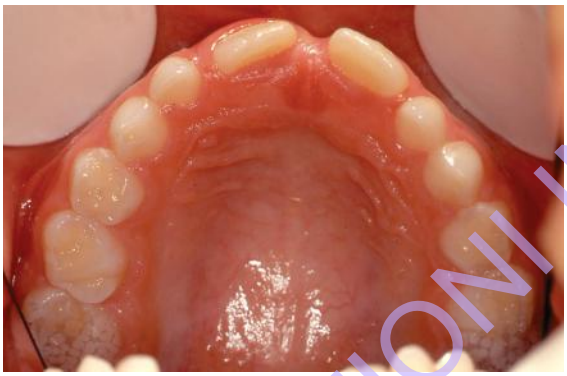

Figure 6
Pretratment maxillary arch.

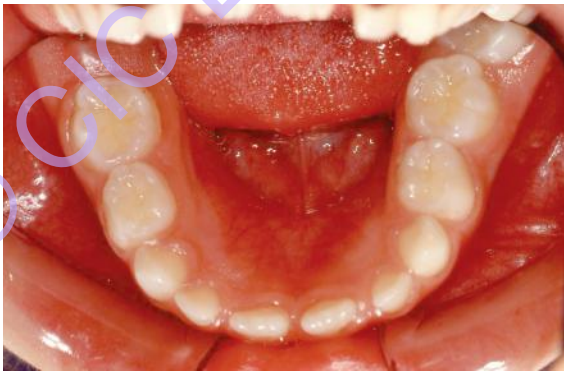

Figure 7
Pretratment mandibular arch

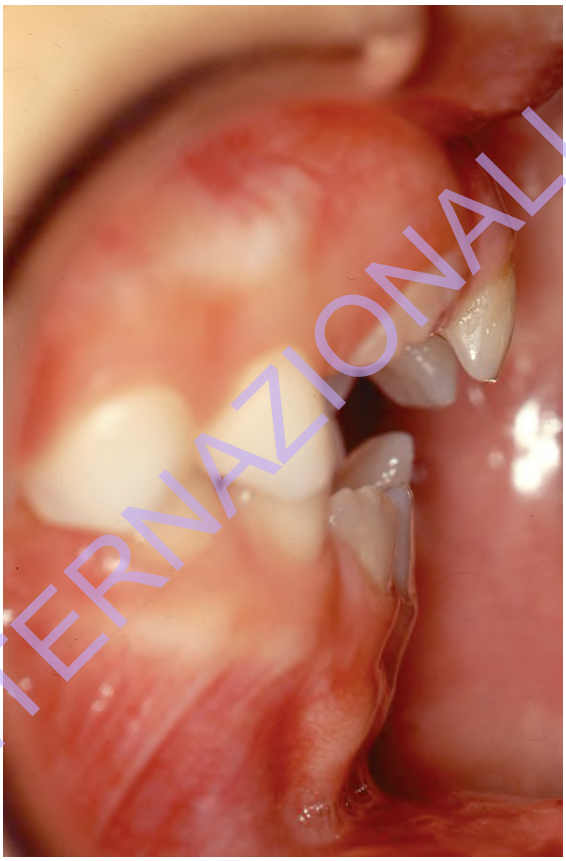

Figure 8
Pretratment overjet-overbite.

Table 6 - Dental elements for hemiarch.

1°Quadrant	1.1	5.2	5.3	5.4	5.5	1.6
2°Quadrant	6.1	6.2	6.3	6.4	6.5	
3°Quadrant	3.1	7.2	7.3	7.4	7.5	
4°Quadrant	4.1	8.2	8.3	8.4	8.5	4.6

Table 7 - Cephalometric data:

SNA	97°
SNB	85°
ANB	12
AoBo	+4
McNamara	+12
NSA	119°
Sago	146°
AGOM	127°
Sum	392°
AGON	59th
Ngoma	68°
NS	64mm
SAR	30mm
Argus	34mm
GoMe	68mm
ML-SNL	30°
ML-NSL	3rd
ML-NL	31°
FMA	28°
ML-PO	17
1 ML	100°
1 APG	+3

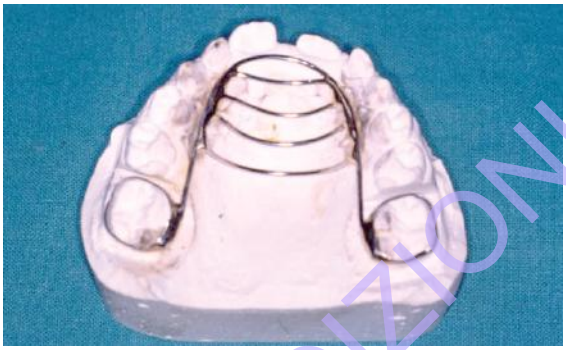

Figure 9
Maxillary orthodontic appliance.

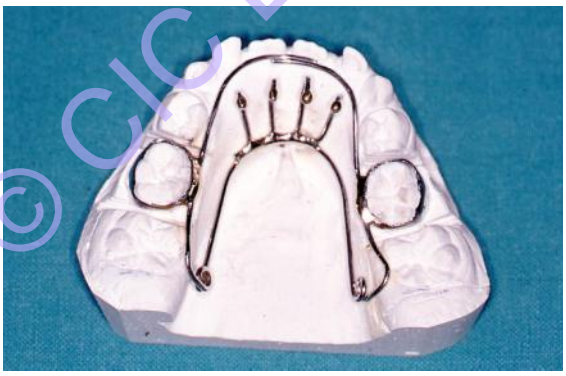

Figure 10
Modified Bihelix.

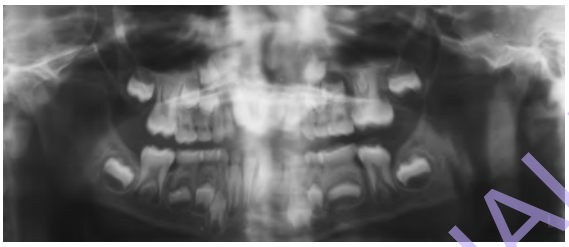

Figure 11
Pretratment orthopantomography

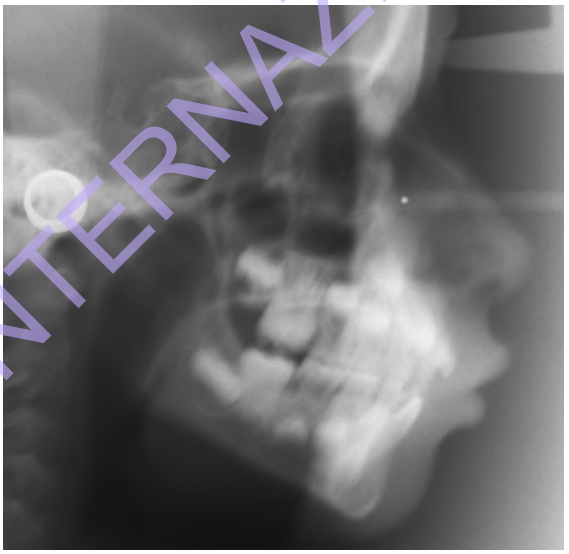

Figure 12
Pretratment cefalograph.

References

1. Klinefelter H F (1984): Background, recognition and description of the syndrome. In: Bandmann H-J, Breit R. (eds) Klinefelter's Syndrome. Springer-Verlag, Berlin, pp1-7
2. Smith C M, Bremner W J (1998): Klinefelter Syndrome. Archive of Internal Medicine 158: 1309-1314
3. Stewart R E (1974): Taurodontism in X-chromosome aneuploid syndromes. Clinical Genetics 6: 341-344
4. Alvesalo L. (1971): The Influence of Sex-chromosome Genes on Tooth Size in man. Proc. Finnish Dental Society 67: 3-54
5. Alvesalo L. (1985): Dental growth in 47 XXY males and in condition with other sex chromosome anomalies. In: Sandberg A. A. (ed.) The Y chromosome, part B: Clinical aspects of Y chromosome abnormalities. Liss, New

York, pp 277-300
6. Hata S, Maruyama Y, Fujita Y, Mayanagy H (2001): The dentofacial manifestations of XXXXY Syndrome: a case report. International Journal of Paediatric Dentistry 11: 138-142
7. Alvesalo L, Osborne R, Kari M (1975): The 47 XXY males, Y-chromosome and Tooth size. American Journal of Human Genetic 27: 53-61
8. Babic M, Micic N, Scepan I (1993): Comparative cephalometric analysis in patients with X-chromosome aneuploidy. Archive of Oral Biology 38/2: 179-183
9. Vaisanen P, Takala I, Alvesalo L, Markkanen H (1988): Periodontal health in 47, XXY men (Klinefelter Syndrome). Proc. Finnish Dental Society 85: 441-444
10. Alvesalo L, Portin P (1980): The 47 XXY Males, sex-chromosome and Tooth size. American Journal of Human Genetic 32: 955-959
11. Alvesalo L, Tammisalo E, Hakola P (1985): Anamel thickness in 47 XXY Males' permanent teeth. Annual of Human Biology 12: 421-427
12. Babic M, Micic N, Jaksic N, Micic S (1991): An extra X chromosome effect on craniofacial morphogenesis in men. European Journal of Orthodontics 13: 329-332
13. Alvesalo L., Laine T. (1992): Occlusion in 47 XXY (Klinefelter syndrome) men. American Journal of Physical Anthropology 87: 161-165
14. Brook G C D, Gasser T, Werder E A, Prader A, Vanderschueren-Lodewykx M (1977): Height correlations between parents and mature offspring in normal subjects and in subjects with Turner's and Klinefeter's and other syndromes. Annals of Human Biology 4: 17-22
15. Brown T, Alvesalo L, Townsend G (1993): Craniofacial patterning in Klinefelter (47, XXY) adults. European Journal of Orthodontics. 15: 185-194
16. Gardner D G, Girsis S S (1978): Taurodontism, shovel-shaped incisors and the Klinefelter Syndrome. Journal of Canadian Dental Association 8: 372-373
17. Burcoveanu E, Gavrilicta L (1978): Aspects of chronic marginal parodontopathies in the Turner and Klinefelter Syndromes. Rev Med Chir Soc Med Nat Iasi 82: 115-117
18. Garn S M, Lewis A B, Kerewsky R S (1965): X-linked Inheritance of tooth size. Journal of Dental Research 44: 439-441
19. Hata S, Maruyama Y, Fujita Y, Mayanagy H (2001): The dentofacial manifestations of XXXXY Syndrome: a case report. International Journal of Paediatric Dentistry 11: 138-142
20. Keeler C (1973): Taurodont molars and shovel incisors in Klinefelter's Syndrome. Journal of Heredity 64: 234-236

Correspondence to:
Dr.ssa Valeria Parisella
Via Prenestina 129
Scala B, int. 3
00176 Rome
Tel.: 3281889934