Root morphology of mandibular premolars in 40 patients with Turner syndrome

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Abstract

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Aim To analyse root morphology of mandibular premolars in 40 females with Turner syndrome.

Methodology All patients aged 18–50 years (mean ± SD: 26.2 ± 6.22) were clinically and cytogenetically diagnosed and divided into three groups according to karyotype: I – with 45,X ($n = 19$); II – with 46,X,i(Xq) and other structural changes of this chromosome ($n = 8$); III – with mos45,X/46,XX and other mosaic karyotype ($n = 13$). The control group consisted of 30 healthy women aged 20–50 years (mean ± SD: 31.52 ± 5.21) who underwent dental treatment at the Department of Conservative Dentistry and Department of Periodontology and Oral Mucosa Diseases, Medical University of Gdańsk, Poland. The root morphology of mandibular premolars was studied based on orthopantomogram X-ray images. The results were analysed using chi-square test with Yates's adjustment.

Results Separate mesial and distal root canals and separate root apices were noted on orthopantomograms in patients with Turner syndrome. Two-rooted mandibular first premolars were observed in 34% of cases in group 45,X (group I), in 31% of cases in the group with structural aberrations of chromosome X (group II) and in 31% of cases with mosaic karyotypes (group III). Two-rooted mandibular second premolars were observed in 39% cases in group 45,X and in 31% of cases in the group with structural aberrations of chromosome X and in 35% of cases with mosaic karyotypes. This type of root morphology was not observed in the control group. No significant difference was found between the three groups of Turner syndrome.

Conclusion Highly significant differences in root morphology of mandibular premolars between patients with Turner syndrome and a population control group were found.

Keywords: root morphology, Turner syndrome, X chromosome.

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Introduction

Turner syndrome is a sex chromosomal disorder associated with a female phenotype. Chromosomal studies have shown that Turner syndrome is characterized by the presence of a single normal X chromosome; an isochromosome for the long arm of chromosome X [46X,i(Xq)] or other structural abnormalities of this chromosome and different mosaics (mostly 45X/46XX) are found in approximately 17 and 24% cases respectively (Hall & Gilchrist 1990, Robinson & de la Chapelle 1996). Abnormalities in patients with Turner syndrome include: short stature, infantile external genitalia, webbing of the neck, cubitus valgus, anomalies in the structure of some internal organs (Palmer & Reichmann 1976). Some oral disorders were also observed, such as occlusal anomalies (Knychalska-Karwan *et al.* 1981, Harju *et al.* 1989, Laine *et al.*

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1992, Szilagyi *et al.* 2000), early permanent teeth development (Filipsson *et al.* 1965), high arched palate (Knychalska-Karwan *et al.* 1981), small teeth (Townsend *et al.* 1984, Varrela *et al.* 1988, Mayhall *et al.* 1991, Midtbo & Halse 1994a, Kusiak *et al.* 2000) and abnormality of mandibular teeth in terms of root number (Varrela 1990, 1992, Mayhall & Alvesalo 1992, Midtbo & Halse 1994a).

The aim of this investigation was to analyse root morphology in relation to the number of roots in mandibular premolars in patients with Turner syndrome.

Materials and methods

Forty patients, aged 18–50 years (mean ± SD: 26.52 ± 6.22) with Turner syndrome were studied. The diagnosis of Turner syndrome and karyotype evaluation were carried out at the Department of Biology and Genetics, Medical University of Gdańsk, Poland. The patients were divided into three groups according to the karyotype:

I. consisted of 19 patients with 45,X;

II. comprised eight patients with following aberrations of chromosome X: 46,X,i(Xq) ($n = 5$), 46,X,inv(Xp) ($n = 2$), 46,X,r(X) ($n = 1$);

III. group included 13 patients with following mosaic karyotype: mos45,X/46,XX ($n = 4$); mos45X/46,XY/47,XYY ($n = 4$); mos45,X/46,XX/47,XXX ($n = 2$); mos45,X/46,X,t(XX) ($n = 2$); mos46,XYinv(Yp)/45,Xinv(Xq) ($n = 1$).

The control group consisted of 30 healthy women aged 20–50 years (mean ± SD: 31.52 ± 5.21) who underwent dental treatment at the Department of Conservative Dentistry and Periodontology and Oral Mucosa Diseases, Medical University of Gdańsk, Poland.

The root morphology of mandibular premolars was studied on orthopantomogram X-ray images. First and second premolars with a single root or two roots were noted.

The results were analysed using chi-square test with Yates's adjustment, by means of which differences in the frequency of two rooted premolars in females with Turner syndrome and in the control group were compared.

Results

Numerous abnormalities within premolar teeth in Turner patients were found.

Table 1 shows the frequencies of the single-rooted and two-rooted forms of mandibular first and second premolars in three groups of karyotype: 45X, structural aberrations of chromosome X and mosaic cases. Two-rooted forms of mandibular first premolars were found in 13 teeth (34%) of the 45,X group (Fig. 1), two-rooted forms of mandibular first premolars were found in five teeth (31%) in those with structural aberrations of chromosome X (Fig. 2) and in eight teeth (31%) in those with mosaics (Fig. 3). No two-rooted first premolars were found in the control group. Differences in two-rooted premolars in all groups with Turner syndrome in comparison with the control group were significantly different ($P < 0.05$). There were no statistically significant differences between 45,X, mosaics and the group of patients with structural aberrations of chromosome X. Two-rooted forms of mandibular second premolars were found in 15 teeth

Table 1 Frequencies of the single-rooted and two-rooted forms of mandibular first and second premolars in Turner syndrome and control group

	45,X (I) ($n = 19$)		Aberrations of chromosome X (II) ($n = 8$)		Mosaics (III) ($n = 13$)		Control group 46,XX ($n = 30$)	
	N	%	*N*	%	*N*	%	*N*	%
Mandibular first premolars								
Missing	4	11	2	13	3	11	0	0
Single-rooted	21	55	9	56	15	58	60	100
Two-rooted	13	34[a]	5	31[b]	8	31[c]	0	0[d]
Mandibular second premolars								
Missing	0	0	1	6	5	19	0	0
Single-rooted	23	61	10	63	12	46	60	100
Two-rooted	15	39[e]	5	31[f]	9	35[g]	0	0[h]

n, number of patients; *N*, number of first or second premolars. $P < 0.05$ in comparison with all groups of Turner syndrome and the control group a–d, b–d, c–d, e–h, f–h and g–h.

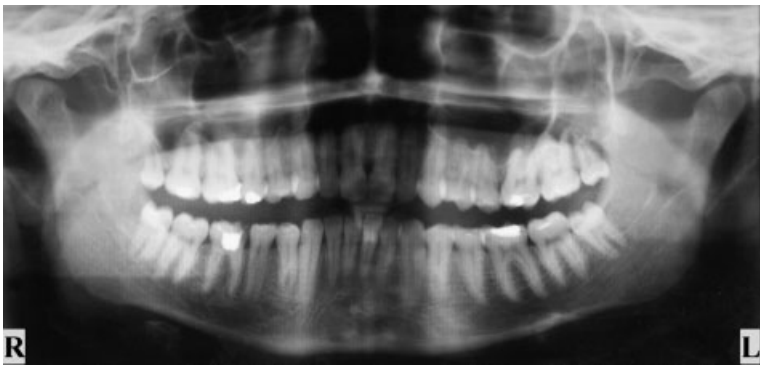

Figure 1 Separate mesial and distal root canals of mandibular premolars 34, 44 and 45 in patient (A.R.) with 45,X.

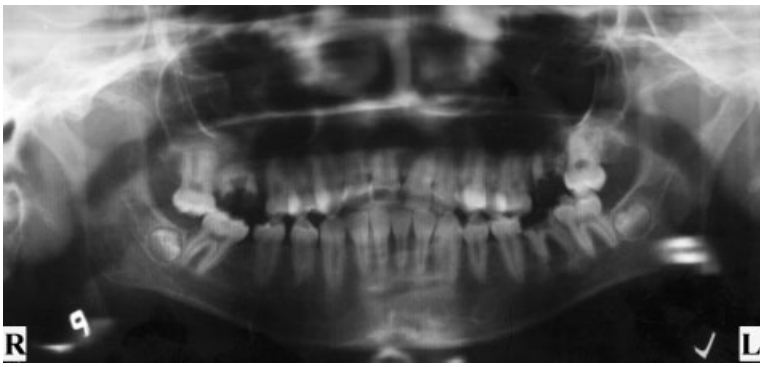

Figure 2 Anomalies of mandibular premolars 34, 44 and 45 in patient (J.R.) with structural aberration of chromosome X 46,X,i(Xq).

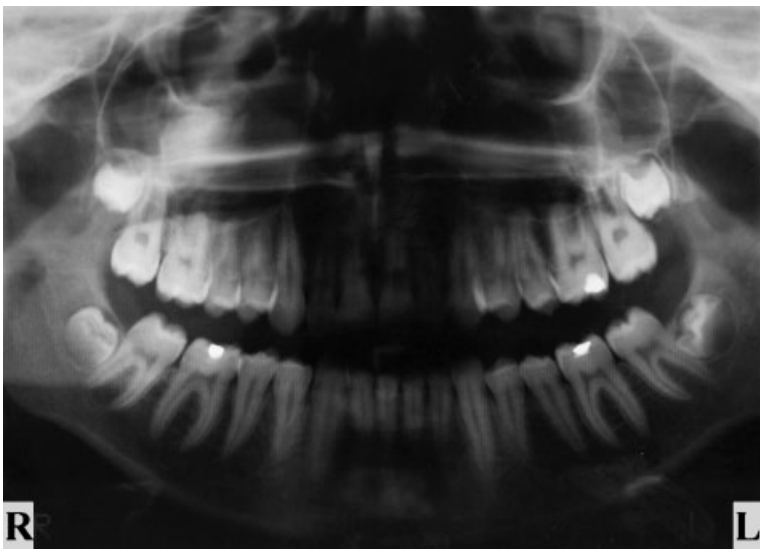

Figure 3 Anomalies of mandibular premolars 34 and 44 in patient (A.P.) with mos45,X/46XX.

(39%) of the 45,X group (Fig. 1), two-rooted mandibular second premolars were found in five teeth (31%) in the group with structural aberrations of chromosome X (Fig. 2) and in nine teeth (35%) in the mosaic group (Fig. 3).

Root anomalies usually affected one, two or three mandibular premolars. In the 15 patients with two anomalous mandibular premolars, nine patients had anomalies in second mandibular premolars only; six patients had anomalies in both first and second

premolars. No cases of Turner syndrome with all four anomalous mandibular premolars were found. No two-rooted second premolars were found in the control group. Differences in the occurrence of two-rooted second premolars in all groups with Turner syndrome in comparison with the control group were significantly different ($P < 0.05$). There were no statistically significant differences between 45,X, mosaics and these patients with structural aberrations of chromosome X.

Discussion

Dental anomalies are observed in numerous genetic syndromes, for example, in Down's syndrome (Bell *et al.* 1989), ectodermal dysplasia (Crawford *et al.* 1991), Turner syndrome (Varrela *et al.* 1988, Mayhall *et al.* 1991, Mayhall & Alvesalo 1992, Midtbo & Halse 1994a,b). The anomalies include tooth size, number and shape of both crown and root. Many authors (Varrela *et al.* 1988, Mayhall *et al.* 1991, Mayhall & Alvesalo 1992, Midtbo & Halse 1994a, Kusiak *et al.* 2000) reported that chromosome X controls tooth size, shape and root morphology. Studies of tooth morphology in those with Turner syndrome showed a decrease in both mesiodistal and buccolingual dimensions (Mayhall *et al.* 1991). The enamel in these patients is also thinner than in control groups (Mayhall & Alvesalo 1992). Furthermore, the roots have a more complex structure in these with Turner syndrome. Within the general population two premolars with two roots are not often seen. Vertucci (1978) reported that 2.3% of premolar teeth had two roots with two canals in first premolars occurring in 25% and second premolars in 2.5% of cases. Zillich & Dowson (1973) reported a second canal in 23.1% of first premolars and 12.1% in second premolars. The present study found that anomalies of root morphology in patients with Turner syndrome occurred more often than in the control group. A large diversity in premolar root morphology in such groups has been reported previously. The most frequent deformities were: two-rooted mandibular first and second premolars with fully developed mesial and distal roots or separate root apices. Varrela (1990, 1992) in his study in 87 patients with 45,X karyotype reported 83 first premolars with separate roots (48% of cases) and only two such premolars in the control group (1% in first premolars). He also found 39% of premolars with two roots in the 45,X/46,XX group (mosaics). In the present study most anomalies were found in the 45,X group with 34% cases with two roots in mandibular first premolars and 39% cases in mandibular second premolars. Midtbo & Halse (1994a) connected root disorders of premolars with one of the chromosome X aberrations or the lack of chromosome X. The absence of chromosome X is claimed to have a stronger influence on that condition. It also influences tooth crown size (Townsend *et al.* 1984, Varrela *et al.* 1988, Mayhall *et al.* 1991, Mayhall & Alvesalo 1992, Midtbo & Halse 1994a, Kusiak *et al.* 2000). A contrast between simple crown structure and more complex root form was demonstrated by Midtbo & Halse (1994a). Furthermore, the study of Lau *et al.* (1990) on the amelogenin gene responsible for amelogenesis imperfecta and other craniofacial diseases is relevant.

Conclusion

Awareness of possible endodontic treatment difficulties in patients with Turner syndrome is a key clinical factor for dental professionals. A substantial number of morphological dental disorders were observed in such patients regardless of the karyotype.

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