Gnathometric Characteristics of Subjects With and Without Signs of Coronary Crowding

Gnatometrijska obilježja ispitanika sa znakovima koronarne kompresije i bez njih

Asja Miličić
Vesna Gaži-Čoklica
Mladen Šlaj
Rajka Brčić

Department of Orthodontics
School of Dentistry
Zagreb University
Zagreb, Croatia

Summary

In a longitudinally surveyed sample consisting of 51 subjects with and 25 subjects without coronary crowding, aged 11 to 13, 6 standard gnathometric variables, Angle classes developmental level of apical base of maxilla and of the orthodontic status found before the replacement of teeth were analyzed. The purpose of the study was to identify relevant factors responsible for the development of crowding, as well as to recognize its early symptoms.

The results of the study showed the following:

– mean sagittal and transversal dimensions of the upper dental arch was significantly lower in subjects with coronary crowding;

– in both groups of subjects, class I was most frequently found, with coronary crowding it was mostly class II/1, and without it class II/2 and class III;

– apical base development level most often coincided with the development of dental arch;

– coronary crowding in deciduous dentition and a very early loss of primary teeth might be an early indication of later coronary crowding;

– carious and nonrestored deciduous teeth favored crowding in permanent dentition.

Key words: gnathometry, coronary crowding

Coronary crowding in one or both dental arches is often found in orthodontic patients (1). It is an elementary characteristic of primary, secondary and tertiary crowdings with Angle Class I, and can be encountered in malocclusions of Angle Classes II/1, II/2 and III as well. It is caused by the lack of space for normal position of teeth because of inappropriate transversal, sagittal or vertical development of the dental arch (1). The unsatisfactory development usually occupies the key position (2). In more expressed cases, signs of disturbed craniofacial development can be found (3).

Data on the frequency of crowding show that it makes about 50% of all malocclusions (2–6). The diagnosis of coronary crowding is based on

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the subjective estimate of clinical findings and on the gnathometric analysis of plaster casts. Individual measurements, after comparison with an average, contribute to making the clinical estimate more objective and the degree of the discrepancy influences the choice of therapeutic procedure.

This study of the problems related to coronary crowding was divided into two parts. The first part referred to statistical processing of gnathometric data obtained in the groups of subjects with and without coronary crowding, and to testing of the determined discrepancies. The second part is an attempt to discover early signs of coronary crowding, because this sample was previously monitored during a period of 8 years.

Examinees and methods

The sample was longitudinally followed and consisted of 76 examinees of both sexes. According to clinical estimate of the conditions in both dental arches, the examinees were divided into two groups (25 examinees without and 51 subjects with signs of coronary crowding). In Table 1, the sample is presented according to age, sex and dentition.

Table 1. *Sample according to age, sex and dentition*

Tablica 1. *Sastav uzoraka prema dobi, spolu i vrsti*

Orthodontic diagnosis	Sex		Age			Dentition			N
	M	F	11	12	13	M	P1	P2	
Without crowding	17	8	6	10	9	5	5	15	25
Crowding	21	30	14	18	19	5	20	26	51

M – mixed dentition
P1 – permanent dentition without second molar
P2 – permanent dentition with second molar

The gnathometric analysis was performed on plaster casts using alginate impressions of dental arches. Six standard gnathometric variables were used i.e. mesiodistal diameters of incisor sum (SI), anterior upper (AW) and posterior upper (PW) widths of the dental arch between 4+4 and 6+6, overbite (OB) and overjet (OJ), and measured with a sliding caliper of a 0.1 mm

precision. The values obtained were summed up. The anterior arch height (AH) was measured by a threedimensional bow divider (Korkhaus).

Intermaxillar relations in habitual occlusion were first fixed in wax and than cast in plaster to be used for determination of Angle classes. Plaster casts were used to estimate the development of the basal part of the maxilla (apical base). The condition of the apical base was estimated on plaster casts as normal, wide or narrow. Results of the gnathometric analysis were processed by standard statistical methods and with a SAS program support. Test results of the discrepancies were included. Among data obtained from the longitudinally followed sample, those related to the orthodontic and dental status on the last examination before the mixed dentition period were selected. The idea was that possible differences in anomalies might be a relevant factor for the occurrence of coronary crowding.

Results

Results of the statistical analysis of the six gnathometric variables obtained in subjects with and without coronary crowding are shown in Table 2. For PW and AH (p < 0,01) and for AW, differences were statistically significant.

Table 2. *Results of the analysis of six gnathometric variables*

Tablica 2. *Rezultati analize 6 gnatometrijskih varijabli*

	SI	AW	PW	AH	OB	OJ	
Without crowding N = 25	30.6	37.2	47.59	18.96	3.32	2.86	x̄
	1.93	2.81	2.93	1.44	1-78	1.92	SD
	6.29	7.56	6.95	7.57	53.58	67.05	CV
	6.5	12.0	12.3	7.0	6.0	9.5	R
	**	*	*				
Crowding N = 51	31.43	35.32	46.09	18.18	3.77	3.16	x̄
	1.96	1.72	1.80	1.74	1.67	1.43	SD
	6.23	4.88	3.90	9.55	44.20	45.30	CV
	9.0	8.0	7.5	6.5	7.0	8.5	R

* p < 0.05   ** p < 0.01

SI – INCISOR SUM
AW – ANTERIOR UPPER WIDTH
PW – POSTERIOR UPPER WIDTH
AH – ANTERIOR ARCH HEIGHT
OB – OVERBITE
OJ – OVERJET
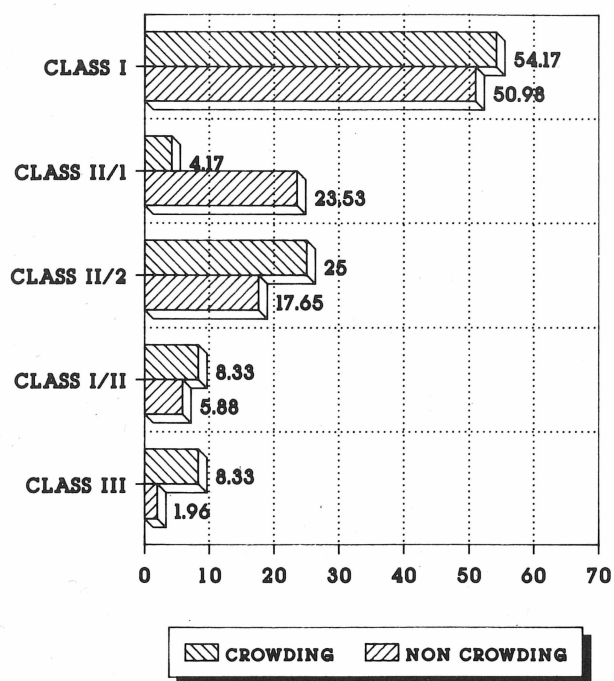
Figure 1. *Angle Class distribution*
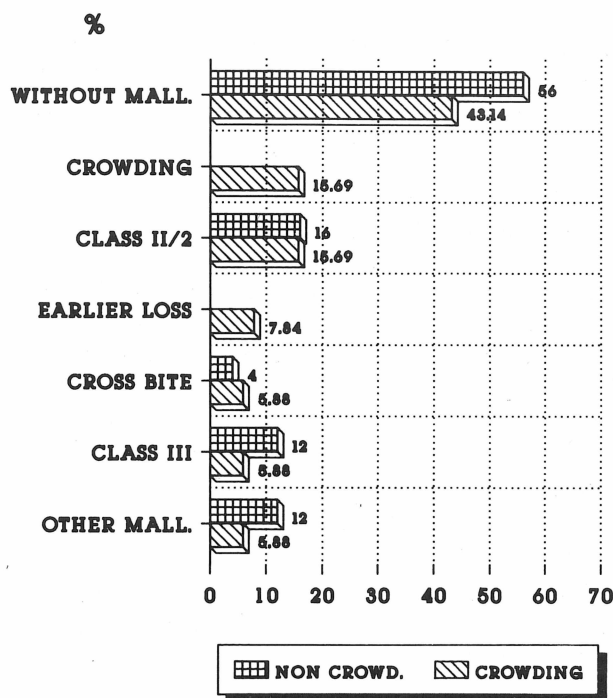Slika 1. *Distribucija klase po Angleu*

Figure 3. *Orthodontic status in primary dention*
Slika 3. *Ortodontski status ispitanika prije početka mijene zubi*
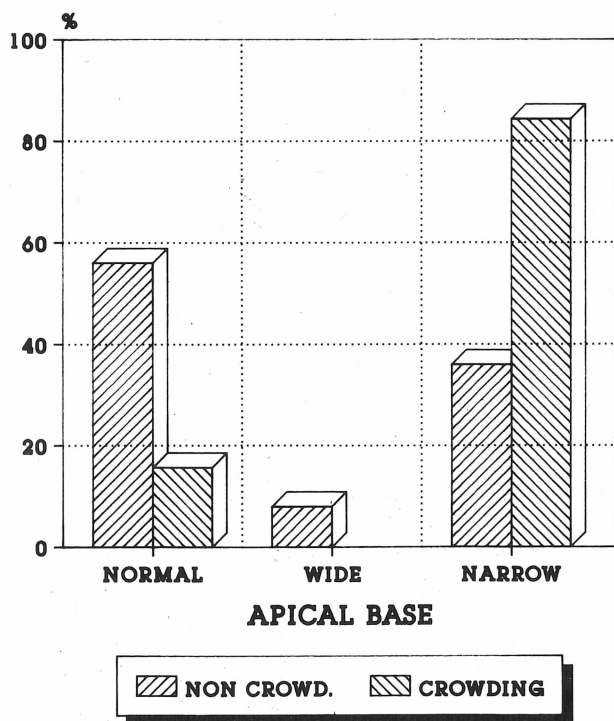

Figure 2. *Distribution of the degree of apical base development*
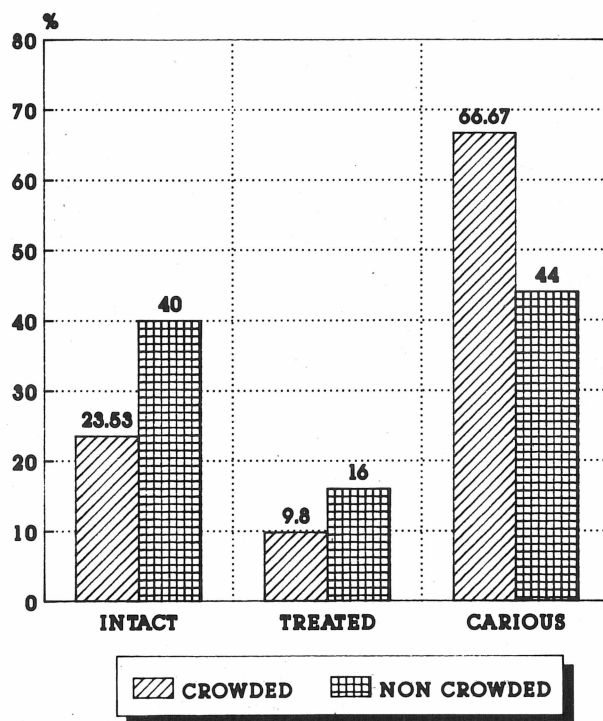Slika 2. *Distribucija stupnja razvijenosti apikalne baze*

Figure 4. *Status of primary dentition*
Slika 4. *Dentalni status u mliječnoj denticiji*

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Figure 1 shows relative frequency of particular forms of sagittal intermaxillary relation (Angle Classes I, II/1, II/2 and III) in both groups of examinees.

Figure 2 shows relative frequency of particular forms of the apical base in both groups.

Figure 3 shows relative frequency of particular orthodontic anomalies in the sample before replacement of teeth. The findings are presented separately for the group which later developed coronary crowding symptoms, as well as for those without these symptoms.

Figure 4 shows relative frequency of intact, treated and carious primary dentitions in both groups of examinees.

Discussion

Gnathometric analysis of the examinees with and without coronary crowding revealed some differences concerning average values of all variables between the two groups. In the group without crowding, most variables showed higher values. Exceptions were the SI and AH, but were not statistically significant.

Earlier studies showed bigger incisors to be one of the causes for coronary crowding (7–11). Another cause could be weaker transversal development of dental arches (12–15), as also shown by our study. While differences between the average values of the SI were not statistically significant, both transversal variables were. These discrepancies were more prominent in the premolar region of the dental arch. Both facts seem to support the hypothesis that in the etiology of coronary crowding a weak transversal development is a more important factor than hereditary conditioned size of teeth. Due to a higher frequency of male subjects with bigger teeth in the group without crowding as compared to a lower frequency in the group with crowding, the analysis of the SI according to sex was made. Results confirmed that frontal teeth were significantly bigger (p < 0.05) in the group with crowding. The differences were 0.54 mm for girls and even 1.66 mm for boys. In order to estimate the intensity of the discrepancy from normal transversal growth, the mean for both groups of our subjects was compared to a previous study (Gaži – Čoklica 1984) (16). The findings proved the clinical estimate to be true.

The group with crowding had both transversal variables lower than the standard (AW 1.44 mm and PW 1.62). In the group without crowding, these values exceeded the standard (AW 0.49 mm and PW 1.62). Positive differences in the group without crowding results from their specific composition, i.e. they included cases of wide dental arches in relation to the size of teeth (Angle Class II/2, microdontism, partial or general spacing), while those previously mentioned included subjects without malocclusions.

The sagital gnathometric variable AH was significantly bigger in examinees without coronary crowding. This difference could also be explained by a specific composition of both groups. In the group without crowding, 5 examinees had protruded upper incisors, which contributed to the increase of the AH variable, while the group with coronary crowding had 10 subjects with retruded incisors. In the group with crowding, overbite (OB) was slightly bigger and the overjet (OJ) somewhat smaller. The differences, however, were not significant. The analysis of the sagital intermaxillary relations in both groups indicated the prevalence of the Angle Class I. Angle Class II/1 was more frequent in the group with crowding, while Angle Class II/2 was relatively more frequent in the group without crowding, suggesting the coronary crowding to be more frequent in Angle Class II/1. In the group without crowding, Angle Class II and combinations of various classes were relatively frequently observed.

Clinical estimate of the development of the apical base indicated pronounced differences between the examined groups. Normally developed apical bases were considerably more frequent in the group without crowding (56% : 15.7%). A few wide apical bases were found only in the group without crowding. In the total sample, narrow apical bases were the most frequent (68.42%), particularly in the group with crowding.

Results of this study indicated that in most cases, the insufficient transversal development of the upper dental arch was connected with insufficient development of the alveolar and probably basal part of the maxilla.

Early signs of coronary crowding could be: the crowding in primary dentition and early loss of deciduous teeth. Considering the sample in total 47.37% of the subjects showed no signs of malocclusion in primary dentition, and 61.11%

belonged to the group with crowding after the change of teeth. On the contrary a relatively more frequent incidence of anomalies of the prognathic kind, and other (diastema mediana, hyperdontia, open bite, hypodontia) in examinees without later diagnosis of coronary crowding brings better prognosis. The condition of teeth in primary dentition in the total sample was not satisfactory. The incidence of intact and treated dentitions was higher in the group without crowding, while the group with later crowding had higher incidence of carious dentitions. This supports the hypothesis that the intact or treated primary dentition is one of the conditions for normal transversal and sagital development.

In order to be more sure about the existence of early signs of coronary crowding in permanent dentition, more factors concerning the development and occlusion of primary teeth should be included in future studies.

Conclusions

The results of the study indicated that:

– mean values of transversal and sagital dimensions of the upper dental arch of subjects with coronary crowding were significantly lower than in those without coronary crowding;

– Class II/1 was more frequent in subjects with coronary crowding, while Class II/2 was more frequent in the group without coronary crowding;

– the degree of development of the apical base usually corresponded to the degree of development of the dental arch;

– crowding in primary dentition and a loss of supporting teeth could be a relevant factor in the evolution of coronary crowding of permanent teeth;

– carious or untreated primary teeth favored the development of coronary crowding in permanent dentition.

GNATOMETRIJSKA OBILJEŽJA ISPITANIKA SA ZNAKOVIMA KORONARNE KOMPRESIJE I BEZ NJIH

Sažetak

Na longitudinalno praćenom uzorku sastavljenom od 51 ispitanika s koronarnom kompresijom i 25 ispitanika bez nje, u dobi od 11 do 13 godina, izvršena je analiza 6 standardnih gnatometrijskih varijabli, klasa po Angleu, stupnja razvoja apikalne baze gornje čeljusti, te ortodontskog i dentalnog statusa utvrđenog prije početka mijene zubi istih ispitanika. Svrha istraživanja bila je utvrditi relevantne čimbenike odgovorne za nastanak kompresije, te razotkriti rane znakove u razvoju kompresije. Rezultati istraživanja upućuju na slijedeće:

– prosječne sagitalne i transverzalna dimenzija gornjeg zubnog luka signifikantno su niže u ispitanika s koronarnom kompresijom;

– u obje grupe ispitanika najučestalija je klasa I, kod koronarne kompresije učestalija je klasa II/1, a u grupi bez kompresije klasa II/2 i klasa III;

– stupanj razvoja apikalne baze najčešće je u skladu s razvojem zubnog luka;

Address for correspondence:
Adresa za korespondenciju:

Prof. dr. Asja Miličić
School of Dentistry
41000 Zagreb
Gundulićeva 5, Croatia

– kompresija u mliječnoj denticiji i veoma rani gubitak zubi potporne zone mogli bi se smatrati jednim od neposrednih uzroka kompresije u trajnoj denticiji;

– kariozni odnosno nesanirani mliječni zubi pogoduju nastanku koronarne kompresije u trajnoj denticiji.

Ključne riječi: *gnatometrija, koronarna kompresija*

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