

Establishing Cephalometric Norms using Sagittal and Vertical Occlusal Cephalometric Analysis of Pancherz for Dakshina Kannada Children

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Abstract:

Background: The purpose of this study was to establish norms for the sagittal occlusal (SO) and vertical occlusal (VO) cephalometric analyses of Pancherz for Dakshina Kannada children and to analyze and compare the difference between boys and girls of same age group (10-14 years).

Materials and Methods: Two hundred and sixty-three (132 boys and 131 girls) children of Dakshina Kannada were included in this study. Lateral cephalometric radiographs of children belonging to the age group of 10-14 years were taken. Dental lateral cephalometric radiographs were obtained and these cephalometric radiographs were then manually traced. All the parameters considered in the Pancherz analysis were considered while establishing the norms for Dakshina Kannada children.

Results: Statistically significant sex differences were found for 9 of 11 parameters in the sagittal occlusal analysis, and 10 of 10 in the Vertical occlusal analysis.

Conclusions: For the sagittal and Vertical occlusal analyses of Pancherz a separate sex-specific standards are needed for Dakshina Kannada children.

Key Words: Cephalometric analysis, cephalometric norms, Pancherz analysis

Introduction

Since the introduction of cephalometrics by Broadbent in 1931, its role has been vital in orthodontic diagnosis and treatment planning, and for monitoring treatment and growth changes.¹ The diagnostic norm is a standard, which helps us to determine the extent of deviations from the

“normal” or what is considered “healthy.” A shortcoming of various studies attempting to establish population standards (“norms”) is that a wide range of ages or only adults were considered. “Norms” should ideally be valid for children at the age when orthodontic treatment usually commences, i.e., close to 12 years.²⁻⁵ Patients most commonly undergo orthodontic treatment at around 10-14 years of age, and priority should be given to obtain solid norms for this age group.⁶⁻⁹ The Pancherz and pitchfork cephalometric analyses are commonly used for the evaluation of treatment changes. Pancherz and Wu and others had established norms for Whites and Chinese children.¹⁰ The Pancherz method has been used not only for evaluation of treatment but also for comparison of dentofacial morphology. The Pancherz cephalometric analysis comprises of 2 parts, the sagittal occlusal analysis (SO analysis), and vertical occlusal analysis (VO analysis), which make it possible to distinguish between sagittal and vertical dentofacial problems and changes.¹⁰⁻²⁹ In orthodontic practices, a diagnosis is determined, in part, by comparing a patient’s cephalometric measurements to standard norms. These norms may be however specific to an ethnic group and cannot always being applied to other ethnic types.

Material and Methods

Two hundred and sixty-three (132 boys and 131 girls) children of Dakshina Kannada were included in this study. Fresh lateral cephalometric radiographs of children belonging to the age group of 10-14 years were taken from various schools in Dakshina Kannada using PLANMECA - 9200 - Proline XC with Dimax 3 X-ray machine after taking their parents consent. Inclusion criteria: (1) All subjects are in the age group of 10-14 years. (2) All set of complement teeth was present for that age. Exclusion criteria: (1) No history of previous and current orthodontic treatment. (2) No history of obstructed nose breathing. (3) Craniofacial anomalies and any other syndromes. Figure 1 illustrates The land marks and planes used in pancherz Aanalysis

Land marks used in this study

1. Ii - Incision inferior: The incisal tip of the most prominent mandibular incisor.
2. Is - Incision superius: The incisal tip of the most prominent maxillary incisor.

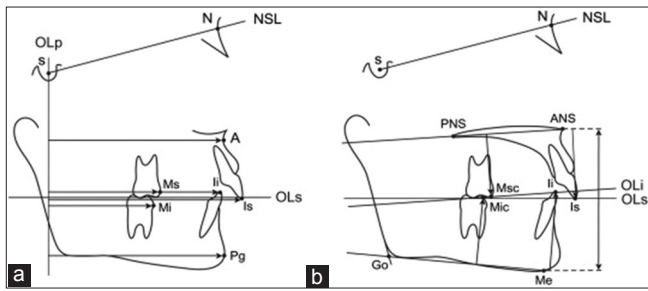


Figure 1: (a) Diagrammatic view of sagittal occlusal analysis. (b) Diagrammatic view of vertical occlusal analysis.

3. Mi - Molar inferius: The mesial contact point of the mandibular first permanent molar by a tangent parallel to OLp.
4. Mic - The mesiobuccal cusp tip of the mandibular first molar.
5. Ms - Molar superius: The mesial contact point of the maxillary first permanent molar by a tangent parallel to OLp.
6. Msc - The mesiobuccal cusp tip of the maxillary first molar.
7. Pg - Pogonion: The most anterior part of the bony chin determined by a tangent parallel to OLp.
8. A - The deepest point on the anterior contours of the maxillary alveolar projection determined by a tangent parallel to OLp.
9. N - Nasion.
10. S - Sella.
11. ANS - Anterior Nasal Spine.
12. PNS - Posterior Nasal Spine.
13. Me - Menton.
14. Go - Gonion.

Planes used in this study

1. NL – Nasal line (Maxillary plane – ANS – PNS)
2. ML – Mandibular line (Mandibular plane – Me – Go)
3. NSL – Nasal Sella Line.
4. OLS – Maxillary Occlusal Plane.
5. OLi – Mandibular Occlusal Plane.
6. OLp – Occlusal Plane perpendicular-Reference line perpendicular to OLS through S.

SO measurements used in the study with abbreviations

Parameters used for SO analysis		
Over jet	Is-OLp – Ii-OLp	mm
Molar relation	Ms-OLp – Mi-OLp	mm
Maxillary base position	A-OLp	mm
Mandibular base position	Pg-OLp	mm
Jaw base relationship	A-OLp – Pg-OLp	mm
Maxillary central incisor position	Is-OLp	mm
Mandibular central incisor position	Ii-OLp	mm
Maxillary central incisor relation to A Point	Is-OLp – A-OLP	mm
Mandibular central incisor relation to Pg Point	Ii-OLp – Pg-OLp	mm
Maxillary first permanent molar position	Ms-OLp	mm
Mandibular first permanent molar position	Mi-OLp	mm

VO measurements used in the study with abbreviations

Parameters used for VO analysis		
Overbite	Ii-Ols	Mm
Lower facial height	ANS-Me	Mm
Maxillary central incisor position	Is-NL	Mm
Mandibular central incisor position	Ii-ML	Mm
Maxillary first permanent molar position	Msc-NL	Mm
Mandibular first permanent molar position	Mic-ML	Mm
Nasal plane angle	NL-NSL	Degrees
Mandibular plane angle	ML-NSL	Degrees
Maxillary occlusal plane angle	OLS/NSL	Degrees

Results

Student’s unpaired *t*-test was used to analyze the variation between boys and girls of Dakshina Kannada. Statistically significant sex differences were found for 9 of 11 parameters in the SO analysis, and 10 of 10 in the VO analysis. The cephalometric norm of the SO for boys is summarized in Table 1. The cephalometric norm of the SO for girls is summarized in Table 2. The cephalometric norm of the VO for boys is summarized in Table 3. The cephalometric norm of the VO for girls is summarized in Table 4. The difference in the SO for boys and girls is summarized in Table 5. The difference in the VO for boys and girls is summarized in Table 6. There were large individual variations for all variables for both sexes.

Discussion

This is the first study to provide cephalometric population norms for Dakshina Kannada children using Pancherz’s SO and VO analyses. Originally, these 2 methods (SO and VO analysis) were intended to quantify dental and skeletal changes during orthodontic treatment of Class II malocclusions with various removable and fixed functional appliances. This study was based on cephalograms obtained from a sufficiently large randomized untreated sample of 10-14 years old Dakshina Kannada children. This sample can be considered representative of the dentofacial morphology for that age group. 263 (132 boys and 131 girls) children of Dakshina Kannada were included in this study. All subjects were in the age group of 10-14 years with no history of previous orthodontic treatment or craniofacial anomalies and any other syndromes. For Pancherz’s SO analysis, Table 7, variables like, over jet, position of mandibular base, jaw relationship, maxillary and mandibular central incisor positions, mandibular central incisor relationship to pg, Position of maxillary and mandibular first permanent molar were greater in female subjects. Whereas molar relationship, the position of the maxillary base and maxillary central incisor relationship to A point is greater in male subjects. Furthermore, for Pancherz’s VO analysis, Table 8, all variables except overbite and nasal plane angle were greater in the female subjects. Thus, 10-14 years old Dakshina Kannada children have greater over jet, less overbite, average lower face height, and steeper maxillary and mandibular plane angles with the prevalence of Class II molar relationships considerably higher in the Dakshina Kannada

Table 1: Sagittal measurements for males.

Parameters	N	Mean	SD	Minimum	Maximum	95% CI	P
Overjet	132	6.85	3.64	-2.00	14.50	6.2	7.5
Molar relationship	132	0.25	2.29	-5.00	8.00	-0.14	0.7
Position of maxillary base	132	71.33	4.58	59.00	82.00	70.5	72.1
Position of mandibular base	132	71.44	5.05	57.00	83.00	70.6	72.3
Jaw relationship	132	-0.09	3.45	-11.00	12.00	-0.7	0.5
Position of maxillary central incisor	132	81.59	5.76	64.00	96.00	80.6	82.6
Position of mandibular central incisor	132	74.74	5.05	62.00	86.00	73.9	75.6
maxillary central incisor relationship to A point	132	10.68	6.46	1.00	71.50	9.6	11.8
mandibular central incisor relationship to pg	132	3.31	2.78	-2.50	9.00	2.8	3.8
Position of maxillary first permanent molar	132	49.20	4.48	38.00	60.00	48.4	49.9
Position of mandibular first permanent molar	132	49.14	4.60	41.00	59.00	48.3	49.9

SD: Standard deviation, CI: Confidence interval

Table 2: Sagittal measurements for females.

Parameters	N	Mean	SD	Minimum	Maximum	95% CI	P
Over jet	131	6.93	5.29	-3.00	55.00	6.01	7.84
Molar relationship	131	-0.22	1.94	-4.00	5.00	-0.55	0.11
Position of maxillary base	131	72.06	4.26	59.00	79.00	71.3	72.8
Position of mandibular base	131	72.71	5.21	58.00	84.00	71.8	73.6
Jaw relationship	131	-0.52	3.97	-14.00	7.00	-1.2	0.16
Position of maxillary central incisor	131	81.24	7.25	22.00	91.00	79.9	82.4
Position of mandibular central incisor	131	75.04	5.25	61.00	85.00	74.1	75.9
maxillary central incisor relationship to A point	131	9.56	3.41	0.50	18.00	9.0	10.2
mandibular central incisor relationship to pg	131	2.32	4.68	-13.00	12.00	1.5	3.13
Position of maxillary first permanent molar	131	49.79	4.77	37.00	59.00	49.0	50.6
Position of mandibular first permanent molar	131	50.16	5.06	38.00	61.00	49.3	51.0

SD: Standard deviation, CI: Confidence interval

Table 3: Vertical measurements for males.

Parameters	N	Mean	SD	Minimum	Maximum	95% CI	
						LL	UL
Overbite	132	2.69	1.82	-2.00	7.00	2.4	3.0
Lower orbital height	132	61.28	4.44	51.00	72.00	60.5	62.0
Position of maxillary central incisor	132	26.42	2.74	20.00	33.00	26.0	26.9
Position of mandibular central incisor	132	38.47	3.18	30.00	50.00	37.9	39.0
Position of maxillary first permanent molar	132	20.82	2.55	12.00	28.00	20.4	21.3
Position of mandibular first permanent molar	132	28.89	2.17	23.00	34.00	28.5	29.3
Nasal plane angle	132	8.37	3.82	0.00	19.00	7.7	9.0
Mandibular plane angle	132	34.36	4.69	21.00	44.00	33.6	35.2
Maxillary occlusal plane angle	132	18.98	4.20	7.00	29.00	18.3	19.7
Mandibular occlusal plane angle	132	16.28	4.90	5.00	28.00	15.4	17.1

SD: Standard deviation, CI: Confidence interval

Table 4: Vertical measurements for females.

Parameters	N	Mean	SD	Minimum	Maximum	95% CI	
						LL	UL
Overbite	131	2.74	1.61	-1.00	7.00	2.5	3.0
Lower orbital height	131	59.42	4.47	50.00	70.50	58.6	60.1
Position of maxillary central incisor	131	25.10	2.90	17.00	38.00	24.6	25.6
Position of mandibular central incisor	131	37.79	3.56	30.00	45.00	37.1	38.3
Position of maxillary first permanent molar	131	20.46	2.85	16.00	33.00	20.0	21.0
Position of mandibular first permanent molar	131	28.37	3.37	21.50	36.00	27.7	28.9
Nasal plane angle	131	7.08	3.22	0.00	21.00	6.6	7.7
Mandibular plane angle	131	31.31	5.98	19.00	43.00	30.3	32.4
Maxillary occlusal plane angle	131	17.17	5.30	4.00	35.00	16.3	18.2
Mandibular occlusal plane angle	131	14.16	5.63	2.00	25.00	13.2	15.1

SD: Standard deviation, CI: Confidence interval

Table 5: Difference in sagittal measurements between males and females.

Parameters	Male			Female			P
	N	Mean	SD	N	Mean	SD	
Over jet	132	6.85	3.64	131	6.93	5.29	0.8
Molar relationship	132	0.25	2.29	131	-0.22	1.94	0.07
Position of maxillary base	132	71.33	4.58	131	72.06	4.26	0.2
Position of mandibular base	132	71.44	5.05	131	72.71	5.21	0.04
Jaw relationship	132	-0.09	3.45	131	-0.52	3.97	0.35
Position of maxillary central incisor	132	81.59	5.76	131	81.24	7.25	0.6
Position of mandibular central incisor	132	74.74	5.05	131	75.04	5.25	0.6
maxillary central incisor relationship to A point	132	10.68	6.46	131	9.56	3.41	0.08
mandibular central incisor relationship to pg	132	3.31	2.78	131	2.32	4.68	0.04
Position of maxillary first permanent molar	132	49.20	4.48	131	49.79	4.77	0.3
Position of mandibular first permanent molar	132	49.14	4.60	131	50.16	5.06	0.09

SD: Standard deviation

Table 6: Difference in vertical measurements between males and females.

Parameters	Male			Female			P
	N	Mean	SD	N	Mean	SD	
Overbite	132	2.69	1.82	131	2.74	1.61	0.8
Lower facial height	132	61.28	4.44	131	59.42	4.47	0.001
Position of maxillary central incisor	132	26.42	2.74	131	25.10	2.90	<0.0001
Position of mandibular central incisor	132	38.47	3.18	131	37.79	3.56	0.1
Position of maxillary first permanent molar	132	20.82	2.55	131	20.46	2.85	0.2
Position of mandibular first permanent molar	132	28.89	2.17	131	28.37	3.37	0.1
Nasal plane angle	132	8.37	3.82	131	7.08	3.22	0.004
Mandibular plane angle	132	34.36	4.69	131	31.31	5.98	<0.001
Maxillary occlusal plane angle	132	18.98	4.20	131	17.17	5.30	0.02
Mandibular occlusal plane angle	132	16.28	4.90	131	14.16	5.63	0.001

SD: Standard deviation

Table 7: Difference in Sagittal measurements between males and females.

Parameters	Male			Female			p
	N	Mean	SD	N	Mean	SD	
Overjet	132	6.85	3.64	131	6.93	5.29	0.8
Molar relationship	132	0.25	2.29	131	-0.22	1.94	0.07
Position of maxillary base	132	71.33	4.58	131	72.06	4.26	0.2
Position of mandibular base	132	71.44	5.05	131	72.71	5.21	0.04
Jaw relationship	132	-0.09	3.45	131	-0.52	3.97	0.35
Position of maxillary central incisor	132	81.59	5.76	131	81.24	7.25	0.6
Position of mandibular central incisor	132	74.74	5.05	131	75.04	5.25	0.6
Maxillary central incisor relationship to A point	132	10.68	6.46	131	9.56	3.41	0.08
Mandibular central incisor relationship to pg	132	3.31	2.78	131	2.32	4.68	0.04
Position of maxillary first permanent molar	132	49.20	4.48	131	49.79	4.77	0.3
Position of mandibular first permanent molar	132	49.14	4.60	131	50.16	5.06	0.09

Table 8: Difference in Vertical measurements between males and females.

Parameters	Male			Female			p
	N	Mean	SD	N	Mean	SD	
Overbite	132	2.69	1.82	131	2.74	1.61	0.8
Lower facial height	132	61.28	4.44	131	59.42	4.47	0.001
Position of maxillary central incisor	132	26.42	2.74	131	25.10	2.90	<0.0001
Position of mandibular central incisor	132	38.47	3.18	131	37.79	3.56	0.1
Position of maxillary first permanent molar	132	20.82	2.55	131	20.46	2.85	0.2
Position of mandibular first permanent molar	132	28.89	2.17	131	28.37	3.37	0.1
Nasal plane angle	132	8.37	3.82	131	7.08	3.22	0.004
Mandibular plane angle	132	34.36	4.69	131	31.31	5.98	<0.001
Maxillary occlusal plane angle	132	18.98	4.20	131	17.17	5.30	0.02
Mandibular occlusal plane angle	132	16.28	4.90	131	14.16	5.63	0.001

children compared to Chinese children.¹⁰ Out of 21 parameters which are used in Pancherz's analysis, there were a statistically significant sex differences found in 9 of 11 parameters in the SO analysis and 10 of 10 in the VO analysis.

Conclusion

The results of this study suggest that separate norms for Pancherz's SO and VO analyses are justified for 10-14 years old Dakshina Kannada children. The results also suggest that separate norms are needed for both sexes in different age group. Over jet, position of mandibular base, jaw relationship, maxillary and mandibular central incisor positions, mandibular central incisor relationship to pg, position of maxillary and mandibular first permanent molar were greater in girls, whereas molar relationship, position of maxillary base and maxillary central incisor relationship to A point is greater in boys.

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