Proprotionate linear measurements in radiographic cephalometric assessments

A methodological study

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Craniofacial structures were studied by radiographic cephalometry in 10 boys and 10 girls at 9–14 years and 13 years later. The linear distances were measured in mm as well as with indices with the sella-nasion distance as denominator. The index measurements proved to be dependent on aqe to a rather limited extent. This held true for index measurements referring to skeletal points as well as soft-tissue points.

Key-words: Craniometry; growth, human

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Assessments based on radiographic cephalometric methods play a principal role in orthodontics. This applies to assessments of growth changes as well as treatment changes. One of the difficulties associated with the assessment of treatment changes is the differentiation of these changes from those conditioned by growth. This problem is particularly relevant in orthodontics since the majority of patients are treated during periods of highly intensive growth. One way of converting linear measurements to indices has been presented earlier (*Roos*, 1974), and it appears from that study that the method makes possible a better assessment of treatment changes since the changes due to growth tend to be masked to an appreciable extent when the index measuring procedure is followed.

The aim of the present investigation was to evaluate the index method in terms of its dependency on growth changes. This was done in the form of a semi-longitudinal study.

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MATERIAL AND METHOD

The series, consisting of material collected earlier (*Lundström*, 1969), comprised two cephalograms of each of 10 boys and 10 girls. The average age at the time of the initial recording was 12 years and one month (range: 9 years 1 month to 14 years 2 months), and at the final recording, which, on an average, occurred thirteen years and two months later, the ages averaged 25 years and three months (range: 22 years 0 months to 28 years 4 months).

The profile radiographs were analysed on tracing film. The reference points and lines used are indicated in fig. 1. The distances from the respective reference points to SNP were measured with compasses with a transverse scale. The distances measured in mm were converted to indices by dividing them by the SN distance for the individual concerned and multiplying the quotient by 100. The means, standard deviations and ranges of the distances were calculated both in mm and in indices. A comparison was made between final and initial values and the differences were tested.

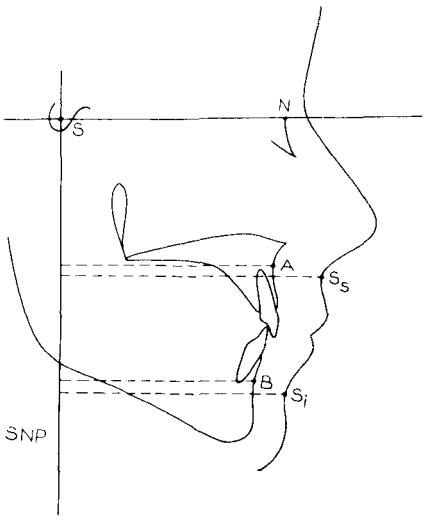

Fig. 1. Reference points and linear measurements on lateral cephalometric radiographs.

- A Subspinale – the deepest point on the anterior contour of the alveolar process of the maxilla
- B Supramentale – the deepest point on the anterior contour of the alveolar process of the mandible
- S_s Sulcus superior – the deepest point on the anterior contour of the upper lip
- S_i Sulcus inferior – the deepest point on the anterior contour of the lower lip

RESULTS

The means, standard deviations and ranges of the distances are given in mm (table I) and as indices (table II), as well as the t values for differences between the initial and final means. For the comparisons in mm significant differences ($P < 0.01$) were noted for the subspinale, the sulcus superior and the sulcus inferior, an almost significant difference ($P < 0.05$) was noted for the supramentale. The indexed distances showed no significant differences.

DISCUSSION

The present study shows the difference between results obtained in a radiographic cephalometric analysis of linear measurements expressed in mm and as indices. As was to be expected since growth changes had occurred between final and initial recordings, significant differences were obtained for linear measurements in mm referring to skeletal points. Relatively small, statistically insignificant differences between final and initial recordings were obtained for the subspinale and supramentale with linear measurements expressed as indices. As regards linear measurements applying to soft-tissue points, significant differences were obtained for the measurements in mm, the indexed measurements, however, showed no significant differences. The fact that the skeletal nasion was used instead of the soft-tissue nasion also for indexing soft-tissue

Table I. *Linear measurements in mm*

	$\bar{x}$	S.D.	t	Range
A_{init}	61.67	3.51	3.14**	12.90
A_{fin}	66.92	6.60		29.40
B_{init}	50.04	5.01	2.02*	16.40
B_{fin}	54.30	8.00		31.30
S^{s}_{init}	74.87	3.84	3.56**	12.50
S^{s}_{fin}	81.75	7.73		30.60
S^{i}_{init}	61.14	5.18	2.90**	19.70
S^{i}_{fin}	67.93	9.11		39.00

** $P < 0.01$
* $P < 0.05$

Table II. *Linear measurements expressed as indices*

	$\bar{x}$	S. D.	t	Range
A_{init}	85.93	5.74	0.55	18.95
A_{fin}	87.08	7.44		29.17
B_{init}	69.78	9.26	0.29	29.99
B_{fin}	70.68	10.22		35.78
S^{s}_{init}	104.30	6.13	0.89	21.87
S^{s}_{fin}	106.32	8.17		33.41
S^{i}_{init}	85.19	9.04	1.00	31.11
S^{i}_{fin}	88.38	10.96		44.46

linear measurements is probably of no importance, as it has been clearly demonstrated in earlier studies that the soft-tissue thickness at the nasion is practically constant (*Subtelny*, 1959, and *Wisth*, 1972). The tendency is thus the same for both skeletal and soft-tissue points: the indexed distances were found to be considerably less dependent on age than the linear measurements in mm. The present study seems to indicate that it is advantageous to use indexed linear measurements when assessing changes due to treatment.

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