Cephalometric studies in Palatopharyngeal Complex

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THE importance of cephalometry as a method of investigation for cleft palate cases has been well recognised. It is the only method by which a true picture of the competency of the velo-pharyngeal closure can be obtained. The only drawback, however, in this method is its limitation as it evaluates the competency by static lateral views only, a disadvantage which can be overcome by coordinating this method by means of cine-radiography and study of aero-dynamics of nasopharyngeal air flow.

Present study was designed to evaluate the effectiveness of a clinical method for assessing the competency of the velopharyngeal mechanism by studying the soft palate in the absence of elaborate equipment. Two hundred and seven cases have been evaluated by this technique of which 106 cases had a normal palate and 101 cases had cleft palates. Their ages ranged from 2 months to 26 years.

Methodology

3 lateral views of the skull were taken in profile. One in resting position, and two during phonation of Ah and phonation Eh by the dental cephalometric machine. A constant distance of 1 5 metres was kept between the X-ray tube and the film (F.F.D.). The exposures however varied with the different ages. For adults exposures of 60 K.V. and 16 M.A.S. were used. For children, 50 K.V. and 12 M.A.S., for neonates 50 K.V. and 10 M.A.S., 8 M.A.S. was used for very small babies with cleft palates as these babies were small and undernourished.

In case of babies upto 3 years and in other noncooperative children only two lateral views were possible, one in resting position, and second in crying position, which has been accepted for phonation. No means of sedation was used for these babies, only patience, time and experience was a guide to shoot the picture at the appropriate moment.

Inference

The main aim in this study has been to evaluate the various parameters of the soft palate, i.e., to study its length and position at rest and during a good effective closure. Measurements of the hard palate and the nasopharyngeal depth were also done. The readings in the cleft cases were then compared with the Normal. This study helped us in selecting the most suitable

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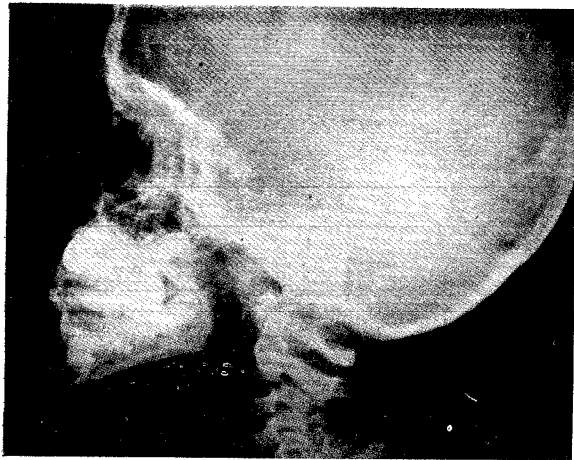**Dept. of Radiology I.P.G.M.E.R. (Calcutta)

Fig. 1—Cephalometric film of a normal case in
resting position

Fig. 2—Cephalometric film of a normal case in phonation
Eh. showing a good contact

Fig. 3—Cephalometric film of a normal case in phonation
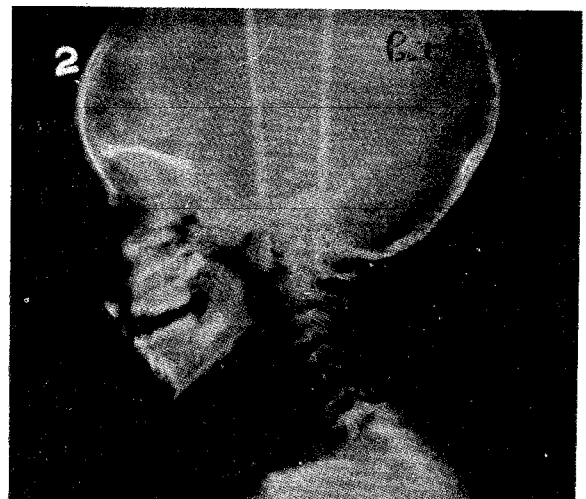Ah. Showing a good contact

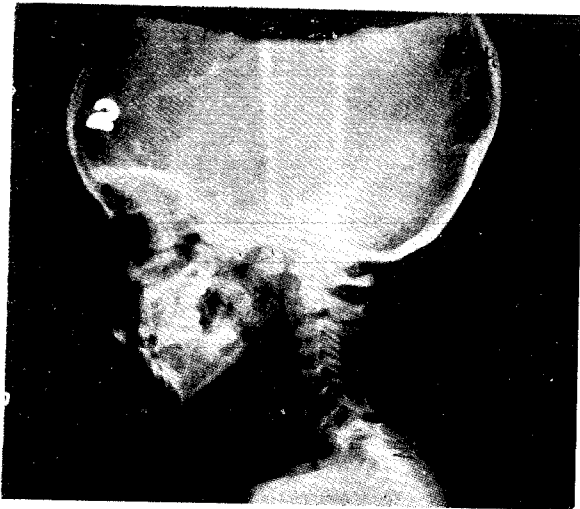Fig. 4—Cephalometric film of a cleft palate in resting
position

Fig. 5 -Cephalometric film of a cleft palate in phonation
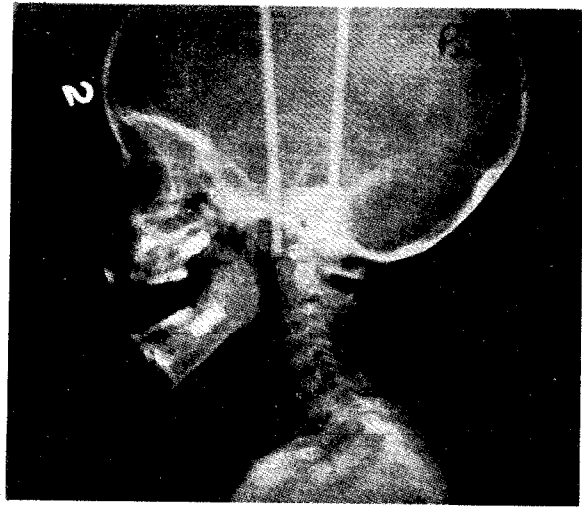Eh. Short soft palate. no contact.

Fig. 6—Cephalometric film of a cleft palate in phonation
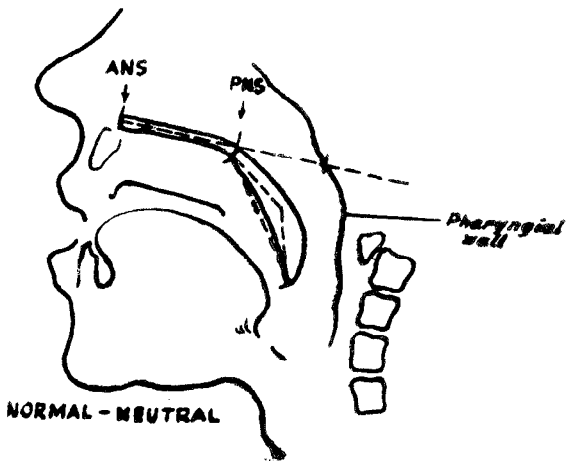Ah. Short soft palate. Slight elevation but no contact.

Fig. 7—Diagramatic presentation of palatopharyngeal complex
in normal in resting position. Showing also the measurements
used for hard palate, soft palate and nasopharyngeal depth.
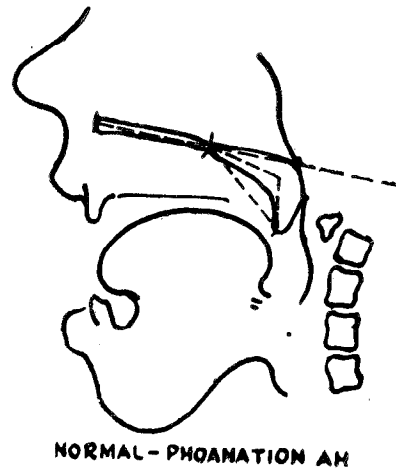

Fig. 8—Measurements used during phonation in normal
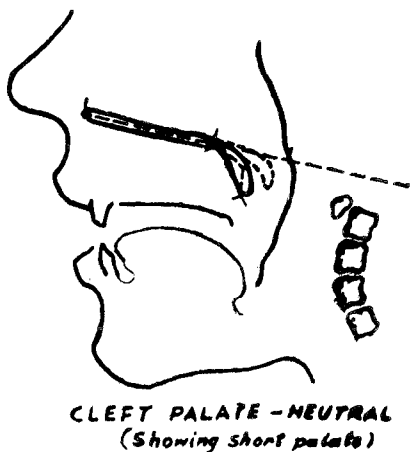case for hard palate, soft palate and
nasopharyngeal depth.

Fig. 9 -Diagramatic presentation of palatopharyngeal
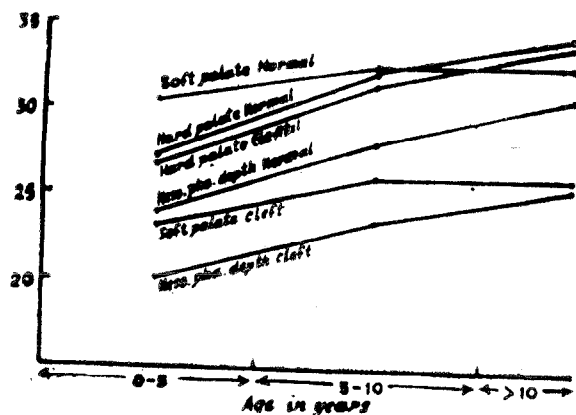complex in cleft palate, showing the measurement
used

Fig. 10—Graphic representation of the growth of the hard
palate, soft palate and nasopharyngeal depth in
106 Normal and 101 Cleft individuals.

surgical procedure for the patient and also in assessing the post-operative results.

Both normal and cleft cases were divided in three main age groups, 0-5 years, 5 to 10 years and above 10 years. This categorisation was arrived at after realising that approximate measurements were reasonably consistent in each group.

Measurements :

1. The hard palate was measured from the anterior nasal spine to the junction of the posterior antral wall meeting the hard palate.

2. Nasopharyngeal depth is defined as the distance from this posterior point to a point where the hard palate line crosses the soft tissue shadow of the pharyngeal wall.

3. For the soft palate different measurements were used :

(i) The shortest length extending from the posterior point of the hard palate to the tip of the soft palate in resting position.

(ii) The axial length was measured by a line along the axis of the soft palate at rest, and in phonation Ah and Eh.

(iii) Area of contact—is the line extending between the 2 points above and below where the soft palate comes in contact with the posterior pharyngeal wall.

In case of clefts only two measurements of the soft palate could be done, one, the shortest length, and the other, the axial

length, at rest and in phonation. Some cases of cleft palate however showed apparent contact. In these cases the soft palate was sufficiently long, as in the submucous cleft variety and in those rare cases which had long bifid soft palates. Often these children have an exceptionally good speech as the lateral pharyngeal walls form a partial contact.

In our series of normal cases the youngest has been 4 months and the oldest 20 years. In the cleft palate series the youngest age has been 2 months and the oldest 26 years. About 50% of the cleft cases were under 4 years of age and only 12 cases were in the above 10 years age group.

Conclusion

From the above results we can conclude the following observations :

1. The soft palate is short in all the cleft cases as compared to the average normal with reference to their corresponding age groups. Our static values here corroborate with the functional cinefluorographic studies that have been carried out by others (Yules, et al 1968)

2. The nasopharyngeal depth is comparatively less in cleft cases in the younger age groups. This observation is contary to the common belief that these dimensions remain unaffected. This probably explains the good results obtained in some of the cleft cases repaired by simple operative techniques. Lack of comprehension of the significance of nasopharyngeal depth could lead to failures of treatment. This was well illustrated in a case where the patient was

operated at 4 years age by a simple operative technique but she came back after 10 years with a bad speech. Cephalometry revealed a long soft palate but the nesopharyngeal depth was too wide. Retropharyngeal dermafat graft was done, and 3 months following the operation, cephalometry showed a good contact, which explained the improvement in speech.

3. Stretching or lengthening of the soft palate with phonation has been observed in both normal cases as well as in the clefts.

4. Only 4 cases showed contact, otherwise all cases of cleft palate showed a short vellum or soft palate. These four cases were of postalveolar type with long bifid soft palates. An average gap of 6 59 mm. in Eh position and 5.88 mm. in Ah position was observed.

It becomes obvious that Cephalometry plays a useful role not only preoperatively in assessing the length and the state of the cleft palate but also postoperatively in judging the benefits of the treatment.

The importance of effective velopharyngeal closure lies not only in the mechanical shutting off of the nasopharynx from the oropharynx, but also it is equally significant in producing a near normal speech. The underlying mechanism controlling the elevation and effective closure of the velopharynx has been described by Fritzell (1969). This is mainly due to the action of two main muscles, the levator palati and the palatopharyngeus, which work in coordination to produce an effective velophar-

yngeal closure in speech. The levator pulls the palate upwards and backwards and the palatopharyngeus contraction pulls the soft palate in a dorso-caudal direction, elevating the pharyngeal wall. The tensor palati in cooperation with the palatoglossus muscle comes into play only in production of nasal sounds.

In conclusion one may assert that both pre and postoperative cephalometric studies of the soft palate become imperative for the assessment of the efficiency of the soft palate and also for choosing the appropriate operating technique.

Observations : Cleft Cases

1. Length of soft palate was short.

2. Nasopharyngeal depth was less in younger age group which became equal to normal with age.

3. Soft palate lengthend during phonation.

4. In clefts the soft palate failed to touch the posterior pharyngeal wall during phonation.

Summary

A total of 207 cases have been studied for assessing the velopharyngeal dimensions by cephalometry. Of these 106 individuals with normal speech served as a baseline with whom 101 cases of cleft palate were compared to assess the lengths of the hard palate, the axial length of the soft palate and the nasopharyngeal depth.

Importance of cephalometry as an

investigation to assess the anatomy, speech pathology and for suggsting appropriate surgery have been discussed.

At the end I would like to thank all those people who helped me complete this paper for presentation. Mr. S. Ghosh and Mr. Prabir Dey without whose cooperation the X-rays would not have been possible.

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Results

TABLE I   Resting Position

(Average Values in m.m.)   Total No. of cases 206
Normal— 106   *Cleft—101*

Age 0	No. of Cases Normal	Cleft	Hard Palate Normal	Cleft	Soft Palate Normal	Cleft	Nasoph. Depth Normal	Cleft
0—5 Yrs.	24	53	26.75	26.57	30.33	23.11	24.04	20.02
			Insignificant		V. H. Significant		V. H. Significant	
5—10 Yrs.	61	36	31 34	30.69	31.85	26.17	28.49	23.86
			Insignificant		V. H. Significant		V. H. Significant	
10 years & above	21	12	34.05	34 33	32.24	27.35	30.38	26.50
			Insignificant		V. H. Significant (0.1% Level)		H. Significant (1.0% Level)	

TABLE II   Phonation

Eh (Average Values in m.m.)
Total No of cases 207. Normal 106 cases, Cleft 101 cases

Age	No. of cases Nor.	Cleft	Hard Palate Nor.	Cleft	Soft Palate Nor.	Cleft	Nasoph. Depth. Nor.	Cleft
0—5 Yrs.	7	14	28.14	28.57	34.71	22.29	27.29	20.64
			Insignificant		V. H. Significant		V. H. Significant	
5—10 Yrs.	61	32	31.38	30.91	36.62	27.72	28.20	24.31
			Insignificant		V. H. Significant		V. H. Significant	
10 years & above	21	12	34.00	34.33	39.81	31.33	30.62	27.42
			Insignificant		V. H. Significant		Insignificant	

TABLE III   Phonation

AH (Average Values in m m.)
Total No. of cases 207. Normal 106 cases, Cleft 101 cases

Age	No. of cases		Hard Palate		Soft Palate		Nasoph. Depth.	
	Nor.	Cleft	Nor.	Cleft	Nor.	Cleft	Nor.	Cleft
0—5 Yrs.	24	53	26.71	26.70	34.83	23.94	24.12	20.02
			Insignificant		V. H. Significant		V.,H. Significant	
5—10 Yrs.	61	36	31.36	30.75	36.87	28.56	28.81	24.33
			Insignificant		V. H. Significant		V. H. Significant	
10 years & above	21	12	33 90	34.33	40.62	32.58	30.38	27.58
			Insignificant		V. H. Significant		Insignificant	

TABLE IV   Phenomenon of Stretching of Axial Length of Soft Palate with Phonation

In Normal Cases   Total cases 106

Age Group	Neutral	Eh	Ah	Significance
0—5 Yrs.	30.33	34.71	34.83	V. H. Significant
5—10 Yrs.	31.85	36.62	39.81	V. H. Significant
10 Yrs. & above	32.24	39.81	40.62	V. H, Significant

In Cleft Cases
Total cases 101

Age Group	Neutral	Eh	Ah	Significance
0—5 Yrs.	23.11	22.29	23.94	No Significant Change
5—10 Yrs.	26.17	27.72	28.56	V. H. Significant
10 Yrs. & above	29.75	31.33	32.58	Significant

Observation : Significant stretching of the soft palate in all the groups.

References

1. Feritzell. B.   :   The Velopharyngeal muscles in speech. Goteborg, 1969.

2. Ganguli, A. C., Rohatgi,   :   Surgical Management of cleft palate. Read at the 2nd
   S., Sen, S.P., and Kundu,   International Congress on cleft palate in Copenhagen,
                        R. N.   August 1973.

3. Yule, R. B.,William,   :   Quantitative Cine radiographic Evaluation of Velopharyn-
   H. N. and Chase, R. A.   geal Incompetence, Plast. and Reconstr. Surg., 42 : 58, 68,