Head Posture in Relation to Slope of the Sella-Nasion Line

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A discussion of the anatomic and postural variables that can confound efforts at relating anatomy and posture. It is directed specifically at the problems addressed in a recent article by Marcotte[1] in this journal.

An article by Dr. Michael R. Marcotte in the July 1981 issue[1] presented some interesting findings regarding head posture and the antero-posterior skeletal relationship of the mandibular symphysis. Relating the chin to nasion and to the maxilla (point A), it was found that skeletal retrusion of the chin tended to occur in combination with an upward tilt at nasion as determined by a more steeply sloping sella-nasion (S-N) line, while protrusion was associated with more horizontal inclinations. The conclusion was that people tend to tilt the head to move the chin toward a more average profile position.

The strongest correlation ($r = +0.45$) was found between the S-N angulation and the antero-posterior distance from nasion to point B, measuring parallel to a horizontal line oriented at an angle of minus 7 degrees to the sella-nasion line. This indicates that about 20 per cent of the antero-posterior variation of B can be explained by variations in slope of the S-N line. Even though Marcotte's 7

degree line represented an average horizontal, its biological variation and correlation with other variables are still dependent on the characteristics of the S-N line.

In explaining his results Marcotte seems to look on the variation in S-N inclination as a direct expression of head posture: "Some people will hold their foreheads high, extend their necks and show some chin prominence" while others "will angle their foreheads forward, flex their necks and hold their chins in."

There is, however, another possible explanation based on structural variation within the cranial anatomy. A forward-upward orientation of the S-N line could also be due to a low position of sella or a high position of nasion, rather than to extension of the entire head. Similarly, a forward-downward inclination could be the result of opposite variations.

As illustrated in Fig. 1, cases do occur where extreme values for the slope of the S-N line must be explained in this way. Further studies are necessary before we can know the extent to which such correlations as found by Dr. Marcotte depend on extension and flexion of the head or on anatomical variations in the cranial base.

It should perhaps be mentioned that both Linder-Aronson[2] and Solow & Greve[3] found changes in head posture to be correlated to nasal air flow-resistance. They found averages of 3.6 and 2.6 degrees of flexion of the head following a change from mouth breathing to normal nasal breathing after adenoidectomy. A corresponding change of 2.7 degrees in the opposite direction was recorded by Fromm & Lundberg[4] after surgical correction of mandibular prognathism.

Those findings emphasize the merit of the suggestion by Dr. Marcotte for further study of possible changes in head posture associated with therapeutic alteration of mandibular position. From this point of view it would have been interesting to know the age distribution of Dr. Marcotte's subjects. Any consistent change in head posture in the form of extension or flexion associated with self-image and chin position would probably be correlated with age and depend on how early the children become aware of their profile appearance.

Investigations into head posture also raise the question of how to orient photographs, radiographs and tracings used as illustrations in professional journals. The Angle Orthodontist prefers that facial profiles be oriented according to the Frankfort horizontal plane. However, this plane varies in relation to the true horizontal when the head is held in a relaxed posture[5-8] (Fig. 2). A presentation based on a natural position of the head would therefore seem preferable, especially in cases of extreme deviation of Frankfort from horizontal in natural posture.

In order to reach a clearer distinction between conditions associated with studies of head posture the following definitions are suggested.

Normal head posture: The mean position of the head when the individual is standing in a relaxed position with the visual axis horizontal. For standardizing purposes this may be accomplished by looking at a distant horizon or measured eye-level reference point, or by looking at the eyes reflected in a vertical mirror at least one meter away.

Flexion of the head: A forward bending deviation of the head from normal posture, or from any other clearly defined head position.

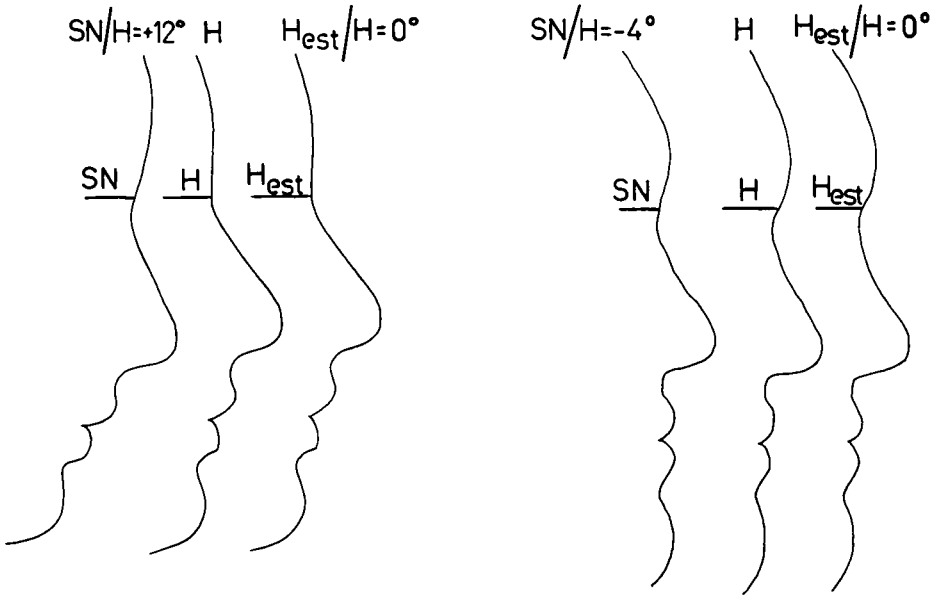

Fig. 1 Orientation of profiles according to the sella-nasion line (S-N), natural posture (H) and estimated natural head posture (Hest)[8] in two individuals representing the maximum and minimum extremes of S-N angulation in a group of 28 dental students[8]

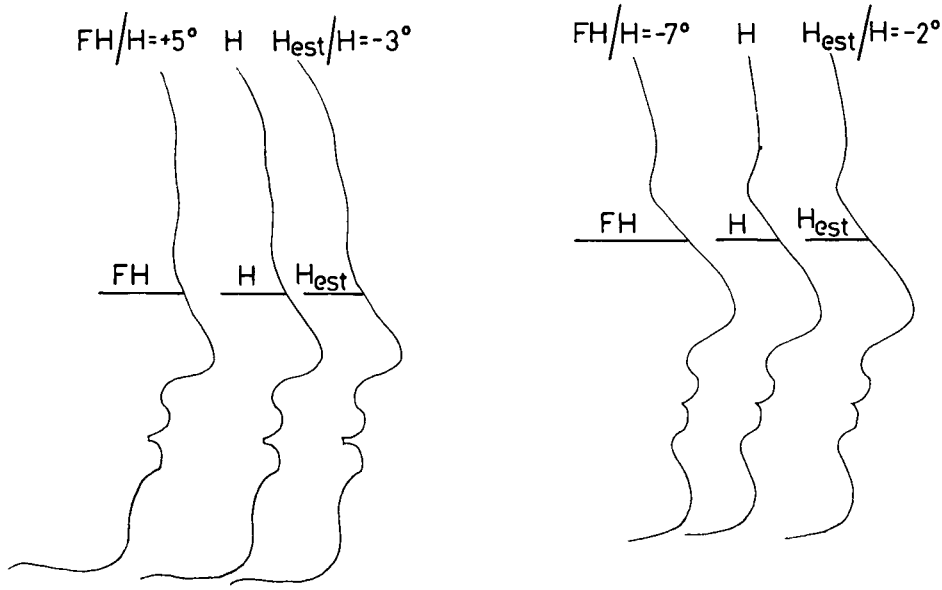

Fig. 2 Orientation of profiles according to the Frankfort plane (FH), natural posture (H) and estimated natural head posture (Hest)[8] in two individuals representing the maximum and minimum extremes of FH angulation to the horizontal in a group of 28 students.[8]

Extension of the head: A backward bending deviation of the head from normal posture, or from any other clearly defined head position.

Variation of inclination of an anatomical reference line: Variation about a mean or arbitrary orientation of the reference line, measured in relation to a *true horizontal* or *true vertical.*

Positive or negative inclination of an anatomical reference line: A forward-upward deviation from the true horizontal is denoted as a *positive* inclination and forward-downward as a *negative* inclination.

REFERENCES

1. Marcotte, M. R.: Head posture and dentofacial proportions. Angle Orthod. 51:208-213, 1981.
2. Linder-Aronson, S.: Naso-respiratory function and craniofacial growth. Monograph No. 9, Craniofacial Growth Series. Center for Human Growth Development, Ann Arbor, Michigan.
3. Solow, B. & Greve, E.: Craniocervical angulation and nasal respiratory resistance. Monograph No. 9, Craniofacial Growth Series. Center for Human Growth and Development, Ann Arbor, Michigan.
4. Fromm, B. and Lundberg, M.: Postural behaviour of the hyoid bone in normal occlusion and before and after surgical correction of mandibular protrusion. Swed. Dent. J. 63:425-433, 1970.
5. Downs, W. B.: Analysis of the dentofacial profile. Angle Orthod. 26:4:191-212, 1956.
6. Bjerin, R.: A comparison between the Frankfort horizontal and the sella turcica-nasion as reference planes in cephalometric analysis. Acta Odont. Scand. 15:1-12, 1957.
7. Moorrees, C. F. A. and Kean, M. R.: Natural head position, a basic consideration in the interpretation of cephalometric radiographs. Am. J. Phys. Anthropol. 16:2: 213-234, 1958.
8. Lundström, A.: Orientation of profile radiographs and photos intended for publication of case reports. Proc. Finn. Dent. Soc. 77:105-111, 1981.

Editor's Note:

As Dr. Lundström notes, use of the Frankfort horizontal is preferred by the ANGLE ORTHODONTIST. *That preference for a widely recognized visual reference is to avoid the confusion and possible deception of random orientation, but it is not a rigid standard. Other orientations used for specific reasons are acceptable as long as they are clearly specified, but the Frankfort plane (or the eye and ear) should be included whenever possible to aid the reader's interpretation. The Marcotte article is a case in point; an identified constructed reference line and true vertical were used, but Frankfort was not available.*