

A Modified Approach for Obtaining Cephalograms in the Natural Head Position

N. SLEEVA RAJU, M.D.S.

K. GANGADHARA PRASAD, M.D.S.

V. P. JAYADE, M.D.S.

Department of Orthodontics, SDM College of Dental Sciences, Dharwad - 580 009, Karnataka, India.

Abstract. Cephalograms taken in the Natural Head Position (NHP), and related to the true vertical and the true horizontal reference planes should logically replace the planes used in conventional cephalometry. This has not happened because of the difficulties in radiographically recording the NHP. This paper presents a modified approach to capture the true vertical reference line on the patients' face itself in NHP, which is then transferred to the conventional lateral cephalogram.

Index words: Natural Head Position, Modified method for NHP, (NHP).

Ever since the concept of Natural Head Position (NHP) was introduced in orthodontics by Downs (1956), Bjerin (1957), and Moorrees & Kean (1958), numerous researchers have studied its application and established its advantages (Moorrees and Kean, 1958; Cooke and Wei, 1988; Lundström *et al.*, 1995). However, it is not universally used for taking cephalograms probably because the current methods of recording NHP are cumbersome. Presently, after attaining the Natural relaxed position of the head by using any of the published methods (Solow and Tallgren, 1971; Siersbaek-Nielsen and Solow, 1982), the cephalogram is obtained by suspending a plumbline in front of the face (Marcotte, 1981) or by using a spirit level (Showfety *et al.*, 1983). The head is not stabilized in a cephalostat for recording the NHP because a rigid head fixation prevents the head from attaining the relaxed natural position. In our experience, when the cephalograms are so taken, they tend to produce a blurred image. In this respect, the photographic superimposition method (Ferraria *et al.*, 1994) seems to be satisfactory, wherein the NHP is captured on a photograph with a plumbline and then superimposed onto a conventional cephalogram. However, it is a tedious procedure because it takes a long time to record and process the photograph, enlarge it accurately to the same size as the radiograph, and then transfer the natural vertical to the radiograph. Hence, a modified approach is developed in which the true vertical is captured on the patient's face and then the cephalogram is taken in the conventional manner.

Methods

A mirror 4 × 2 feet in size is fixed on the wall about 3 feet from floor level. To obtain a true vertical, a plumb line is created by suspending a weight of 4 kg on a 0.016-inch wire hung from the ceiling, 9 feet in front of the mirror. The subject stands to the left of the plumb line looking into the mirror. A Kavo light source (12 V) is fixed 7 foot 6 inches to the right wall, at a height of 5 foot 3 inches (Figure 1). The

light rod can move only in a vertical direction to adjust the level of the light source depending on the subject's head height. The light casts a shadow of the wire on the right side of the patient's face; just distal to the lateral canthus of the eye (Figure 2). The light does not have any horizontal movement thus preventing a shift of the wire shadow in a horizontal direction since this could alter the true vertical reference. The subject's foot marks are marked on the floor so that the individual can be repositioned in the same place to check the precision of the method.

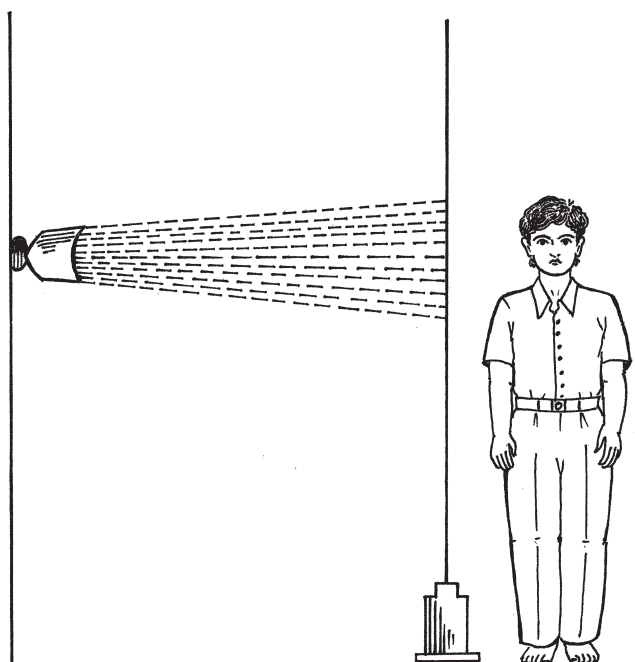


FIG. 1 Drawing. Subject standing in the orthoposition to the left of the plumb line. The light is directed from the right.

The subject is then asked to determine the self-balanced position of the head by tilting the head backward and forward with decreasing amplitude to find the most neutral position in between (Figure 3), as was described by Cooke and Wei (1988). After determining the self-balanced neutral position, the subject is asked to look into his/her own eyes in the mirror. At this juncture, two points are marked using a pen along the wire shadow on the right side of the subject's face, one near the lateral canthus of the eye and the other at the lower border of the mandible (Figure 4). These areas are selected for placing the markers since no important cephalometric landmarks are located here. Most often, it is not possible to mark both the points simultaneously along the shadow of the wire because of the head movement during breathing. Hence, the upper point is marked first, and when the wire shadow comes in line with the upper point, the lower point is marked. Then, the entire procedure is

repeated to check the precision of the method by seeing whether the two points again fall on the shadow of the wire. When it is confirmed that the subject repeatedly gives the same NHP (in other words, the marked points repeatedly fall on the wire shadow), tiny circular metal markers (obtained by cutting the heads off paper pins) are fixed on each point by using a cellophane tape (Figure 5). The markers will give radiopaque shadows on the lateral cephalogram. Thus, the natural vertical axis is fixed on the face.

After completing the above procedure, the subject is positioned in the cephalostat with the help of ear rods and nosepiece, while holding the teeth in centric occlusion. A lateral cephalogram is taken in the standard manner (Figure 6). Figure 7 shows the shadows of the metal markers on the processed cephalogram. A line drawn to join the two marker shadows denotes the natural vertical line on the cephalometric tracing.



FIG. 2 Photograph 1. Shadow of the wire on the face.

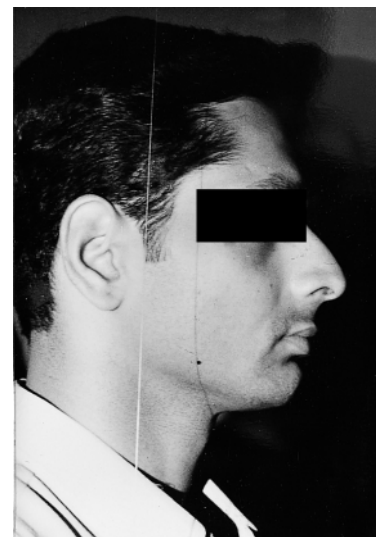


FIG. 4 Photograph 5. Pen markings on the face for placing the markers.

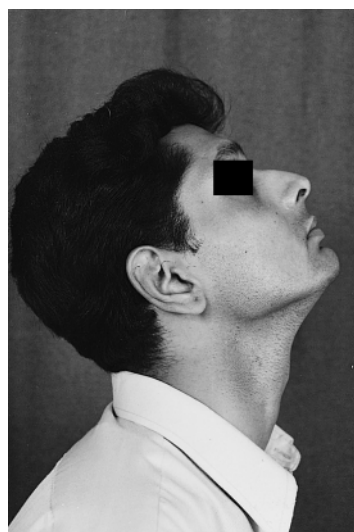
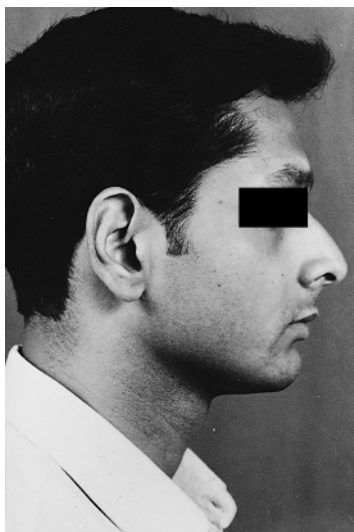


FIG. 3 Photographs 2, 3 and 4. Determination of the self-balanced position of the head by letting the patient tilt the head backward and forward with decreasing amplitude to find the most neutral position in between.

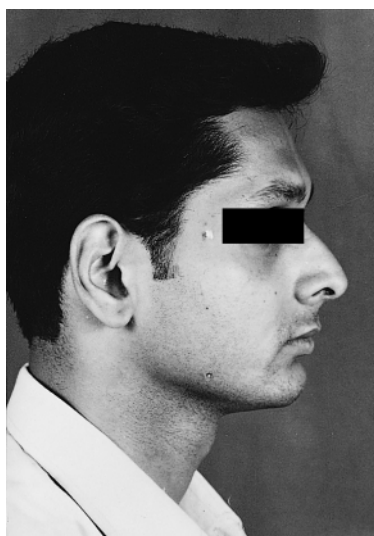


FIG. 5 Photograph 6. Metal markers on the pen markings.



FIG. 7 Photograph 8. Processed cephalogram showing the shadows of metal markers.

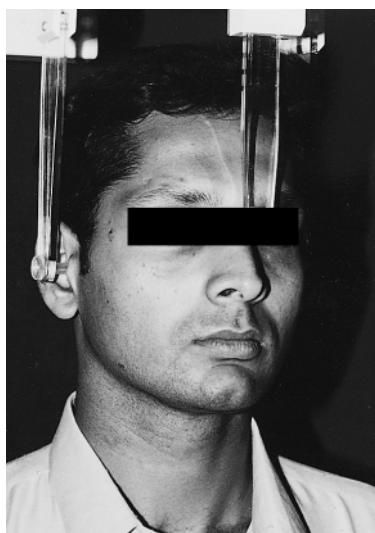


FIG. 6 Photograph 7. Cephalogram is taken in the conventional manner after capturing the true vertical on the face.

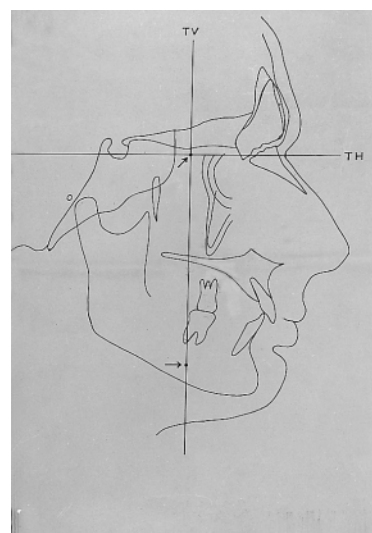


FIG. 8 Photograph 9. True Vertical (by joining the shadows of the metal markers) and the True Horizontal (at right angle to the True Vertical).

While tracing, the cephalogram is rotated so as to align the true vertical, parallel to the side of the rectangular tracing sheet. This helps to orientate the head in NHP on the tracing sheet. Another line at right angle to the true vertical gives the true horizontal (Figure 8). The cephalogram is analysed with respect to these two reference lines.

Discussion

There are two methods of recording a true vertical or a true horizontal reference line utilizing nature's forces, the first, by using a plumb line and the other, with the help of a fluid level device. The first method to relate the NHP to a true vertical has been employed in this paper.

Capturing the NHP while taking a radiograph without the use of a cephalostat is likely to give poor pictures. NHP can be captured on a photograph and then transferred on to

a radiograph. This, however, is a tedious procedure. A method is proposed to capture a true vertical line on the face and then take the conventional cephalogram which records the true vertical line on the radiograph.

This method is found to overcome the drawbacks of the earlier methods of recording the NHP. It is precise, easy and takes less time to perform. The quality of the radiographic images is good since the head is stabilized by the ear rods.

The cephalometric analysis based on NHP will be presented in future articles.

References

Bjerin, R. (1957)

A comparison between the Frankfort horizontal and the sella turcica-nasion as reference planes in cephalometric analysis, *Acta Odontologica Scandinavica*, **15**, 1-12.

Cooke, M. S. and Wei, S. H. (1988)

The reproducibility of natural head posture: a methodological study, *American Journal of Orthodontics*, **93**, 280–288.

Downs, W. B. (1956)

Analysis of the dentofacial profile, *Angle Orthodontist*, **4**, 191–212.

Ferraria, V. F., Sforza, C., Germano, D., Dalloca, L. L. and Miani, A. (1994)

Head position and cephalometric analysis: an integrated photographic and radiographic technique, *American Journal of Orthodontics*, **106**, 257–266.

Lundstroöm, F., Lebert, L. M. L. and Moorrees, C. F. A. (1995)

Natural head position and natural head orientation: basic considerations in cephalometric analysis and research, *European Journal of Orthodontics*, **17**, 111–120.

Marcotte, M. (1981)

Head posture and dentofacial proportions, *Angle Orthodontist*, **51**, 208–213.

Moorrees, C. F. A. and Kean, M. R. (1958)

Natural head position, a basic consideration in the interpretation of cephalometric radiographs, *American Journal of Physical Anthropology*, **16**, 213–214.

Showfety, K. J., Vig, P. S. and Matteson, S. (1983)

A simple method for taking natural head position cephalograms, *American Journal of Orthodontics*, **83**, 495–500.

Siersbaek-Nielsen, S. and Solow, B. (1982)

Intra and inter-examiner variability in head posture recorded by dental auxiliaries, *American Journal of Orthodontics*, **82**, 50–57.

Solow, B. and Tallgren, A. (1971)

Natural head position in standing subjects, *Acta Odontologica Scandinavica*, **29**, 591–607.