NATURAL HEAD POSITION – AN OVERVIEW

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Abstract
Cephalometrics has given us a different perspective of interpreting various skeletal problems in the dentofacial complex. Natural head position is a reproducible, physiologically determined aspect of function. To determine natural head position, a horizontal or vertical reference line outside the crania was used, but generally horizontal line was used. Various intra and extracranial cephalometric horizontal reference planes have been used to formulate diagnosis and plan individualized treatment for an integrated correction of the malocclusion cephalometrics is constantly undergoing refinements in its techniques and analyses to improve the clinical applications. Even though various methods for establishing natural head position have been proposed, still it remains a challenge to the clinicians to implement the concept of natural head position thoroughly in all the stages of treatment because of practical difficulties in the clinical scenario.
Key Words: Cephalometrics, Malocclusion, Natural head position, Skeletal.

Introduction

"Natural head position a standardized and reproducible position, of the head in an upright posture, the eyes focused on a point in the distance at eye level, which implies that the visual axis is horizontal".[1] The concept of natural head position was introduced by *Von Baer* and *Wagner* in 1861. *Broca* in 1962 defined natural head posture as the position of the head with subject standing and the visual axis parallel to horizontal plane.[2] This position was shown to be relevant to craniofacial morphology, future growth pattern, and mode of respiration[3]. While natural head position is a standardized position, natural head posture is a physiologic position of the head, when taking the first step forward from the standing to a moving or walking posture. "orthoposition" characteristic for a person and reproducible, but differs among persons. It was developed by Molhave, a Danish orthopedic surgeon, for studying the biodynamics of the human body. Natural head position is described not as a single angular measurement but as a small range of angle around the natural head position. Thus this position is dynamic and should be recorded as such.[3]

Accoding to Lundström and Lundstromin 1995 "The natural head orientation was defined as the head orientation of the subject perceived by the clinician, based on general experience, as the natural head position in a standing, relaxed body and head posture, when the subject is looking at a distant point at eye level". The concept of NHP was introduced in orthodontics in the 1950s by Downs (1956), Bjerin (1957), and Moorrees and Kean (1958), lundstrom et al.(1995). The concept of natural head posture in the living subject was introduced into the orthodontic literature in the 1950.[4]

Broca defined natural head position of the head with the subject of standing and the visual axis parallel to the hoarizontal plane. This position showed the craniofacial, future growth pattern, and mode of respiration.[3]

Recording of Natural Head Position

In cephalometrics, NHP is readily registered by instructing the subject standing or sitting in the cephalostat to look at a point on the wall in front, exactly at eye level. A small mirror (diameter no more than 10 cm), the midpoint of which also at eye level, can be used also for head orientation. Recording lateral cephalometric radiographs in natural head posture with the cephalostat and ear posts is done as follows: The wire plumb line and suspended weight recorded the true vertical on each radiograph. The longer black thread plumb line served to bisect the reflection of the subject's face in the mirror and minimize lateral head rotation.

Advantage of Natural Head Position

- It provides the use of an extracranial reference line (true vertical/horizontal) for cephalometric analysis.
- When Facial photograph and cephalometric tracing of patient are both taken in Natural Head Position, direct correlation can be made between real-life appearance and tracing
- NHP should be the head position of preference for profile evaluation because it reflects the everyday true-life appearance of people. (Cooke 1986)
- The natural head position of individuals is relatively constant over time (SD $\pm$ 2.05°).

Different Methods of Natural Head Position

1. Fluid Level Device: Given by Showfety et al in 1983.This is used to record the patient's head posture prior to radiographic exposure. Then, the patient with the device attached to the temple, is subjected to the routine cephalometric procedure. The fluid-level device consists of an air bubble; with the ends of the bubble on the ends of a 0.030 inch diameter wire so that the ends of the bubble, or meniscus, are matched to the ends of a piece of wire. The fluid consists of a mixture of radiopaque liquid, blue dye, and a silicone suspension, rendering the air bubble visible on the cephalometric radiograph.

2. Head Strap Double Fluid Level Device: Fluid level device given by Showfety et al. The fluid level device relies on a double sided adhesive tape for attachment onto the patient's temple. In practice however, the use of

a double sided adhesive tape is cumbersome due to the adhesive wearing off and also due to hygiene related issues. The fluid level device incorporates only one fluid level device to record and transfer the NHP. This is satisfactory to record the NHP however it does not control the position of the head in the transverse plane. Our modification is designed to deal with the twin problems faced by the fluid level device.

3. A Modified Approach for Cephalograms in NHP: In this method a mirror of 4 x 2 feet in size is fixed on the wall about 3 feet from the floor level. To obtain a true vertical, a plumbline is created by suspending a weight of 4kg on a 0.016 inch wire, 9 feet in front of mirror. The subject stands to the left of plumb line looking on to the mirror. A kavo light source is fixed 7 foot 6 inches to the right wall, at a height of 5 foot 3 inches. The light rod can move only in a vertical direction to adjust the level of light source depending on the subjects head height. The light cast a shadow of the wire on the right side of patient face, just distal to lateral canthus of the eye. The subject 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.

4. Inclinometer: Given by Murphy et al in 1991. Accurate registration of head position should be done with measuring device that can make dynamic recordings. Recording head posture should be possible during swallowing and mastication. Ideally this device should be easy to use and should not affect head position. At the same time, measurement should be reproducible over long period, and accuracy of the recording should not depend entirely on operator skill.

5. Stereo-Photogrammetry: Given by weber. Recently, a new method for recording Natural head position in stereo-photogrammetry was suggested. The idea was to use the physical references of a pre-captured digital model of a board to correct the orientation of subsequent facial surface models. The stereophotogrammetric NHP method possesses many unique advantages over traditional approaches:

- radiation-free
- patients can be in their own NHP for capturing of facial surface models without the need for any markers/sensors
- only one reference board recording is needed after camera calibration.

6. Multicamera System and a Laser Level: Previous studies have mainly focused on how to record natural head position dimensionally. Now, with the development of computer assisted surgical designed, many authors are using a new methods for recording 3- dimensionally natural head position and integrating it into a computer-assisted surgical designed protocol. Schatz and Xia et al conducted a series of studies on how to record and reproduced natural head position dimensionally using a gyroscope.

7. Three –Dimensionlal Reproducibility: Stimulated by the recent increased in 3D cone beam computer tomography imaging for orthodontic evaluation, studied demonstrated and testing various methods to record natural head position 3d have appeared in the literature. Xia et al used stereolithographic skull models of patients to demonstrate the 3D reproductibility of natural head position.

8. Gaze Tracking System Using an Ultrasonic Sensor for Distance Measurement: Gaze tracking is a technology to find out where a user is looking. It has been widely used in various applications such as neuroscience, psychology, industrial engineering, human factors marketing, advertising, and computer interfaces. Most of the known gaze tracking systems uses the pupil center corneal reflection method. In this method, the position of the corneal specular reflection determined by a near infrared illuminator is regarded as a reference. The final gaze position on the screen is calculated using the vector from the corneal SR to the pupil center and the matrix defining the relationship between the four corner positions of the screen and the corresponding four vectors obtained during calibration.

Conclusion

"The search for an ideal"

Cephalometrics is constantly undergoing refinements in its techniques & analyses to improve the clinical applications. Natural head position a long proposed modification, yet not fully into practice, can be an "ideal" reference for us to improve our cephalometric interpretation.

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