

Head Strap Double Fluid Level Device: An Innovative and User Friendly Design to Record Natural Head Position (NHP)

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ABSTRACT

Head positions can be oriented in a standardized position when the patient stands upright and focusses his/her eyes into a point in infinity. This is the natural head position. This position offers the maximum reproducibility and correlates well with the clinical picture offered to the diagnostician. This article describes an innovative and user friendly method to record natural head position using the head strap double fluid level device, a design modified from the popular fluid level device by Showfety, Vig and Matteson.

Keywords: Head strap, Innovative fluid level device, Natural head position

INTRODUCTION

The concept of NHP was introduced by Von Baer and Wagner [1] in 1861. Broca [2] in 1862 defined NHP as the position of the head in a standing up individual with his visual axis oriented horizontally. The NHP is a standardized and reproducible position of the head in an upright posture, with the eyes focused at a point in the distance at eye level which implies that the visual axis is horizontal [3]. Natural head posture on the other hand refers to the physiologic position of the head when taking the first step forward from the standing to a moving or walking posture, the "orthoposition" as introduced by Molhave.

The importance of using NHP routinely lies in the fact that it being an external reference line will eliminate variations in inclination that are very commonly encountered with intracranial reference lines. Several methods have been proposed to record NHP. The most accurate method was the fluid level device by Showfety et al., [4]. 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.

The fluid level device was introduced to the profession by Showfety et al., [4]. It works on the principle that in a non-accelerating fluid system the surface of the liquid is horizontal. The fluid surface tends to align at right angles to the force of gravity. In a fluid level, the two points where air, glass and the fluid meet will automatically seek the same level relative to gravity. These two points determine a line that is parallel to horizontal. If a wire were to be aligned with these two points then that wire is perpendicular to the gravity defined true vertical.

DESIGN SPECIFICATIONS

The article describes an innovative and user friendly design to record the NHP. The NHP is assumed by enabling the patient to relax and then look into infinity. The patient is advised to flex and extend the neck with decreasing amplitudes till he/she feels fully relaxed [Table/Fig-1]. Patient looks into his/her eyes in a large mirror hung against the patient to simulate infinity.

This device modifies the fluid level device by Showfety et al., [4]. The fluid level device by Showfety et al., [4] used a fluid level device on a pivot, mounted over the patient's temple through the use of adhesive tape. Our modified head strap double fluid level device employs an adjustable head strap made of nylon and employs two fluid level devices. One fluid level device on a pivot is centered over the patient's temple as shown by Showfety et al., [4]. The additional fluid level device is centered over the patient's forehead and does not have a pivot base. The head strap is fully customizable according to the patient's head and the position of the fluid level device on the strap can be adjusted to coincide with the patient's temple and forehead.



[Table/Fig-1]: Patient relaxes the shoulder and neck muscles to assume NHP



[Table/Fig-2]: Patient wearing the head strap double fluid level device

The adjustable head strap makes it possible to use the device on all patients with varying head circumferences. It also does away with use of adhesive tapes to mount the fluid level device that may have issues with hygiene if not replaced periodically and instability due to the adhesive wearing off.

The advantage of using a centered fluid level device on the forehead is that it helps the operator to minimize variations in patient position in a transverse plane, an issue that was earlier not addressed.

The fluid level over the temple helps the operator to record the NHP and reorient the patient in the NHP if required [Table/Fig-2].

DISCUSSION

The NHP is the logical reference and orientation position for craniofacial analysis and illustrations. It is considered as the most appropriate reference plane for orthodontic diagnosis and treatment planning. Facial analysis based on the philosophy of 'Facial Keys' underscores the importance of NHP [5]. The preference for NHP stems from its reliability that has been studied and proved by various authors [4,6]. NHP is more reliable than commonly used intracranial reference planes. However, most patients do not assume this orientation in the day-to-day lives [7]. The errors ensuing from assuming the Frankfort horizontal plane as a guide to patient positioning is documented by Feuer [8] and Tng et al., [9].

Several techniques have been proposed to record NHP notably by Von Baer and Wagner [1], Moorrees and Kean [10], Lundstrom and Lundstrom's [11] photographic technique and Preston's et al., [12] in clinometer mounted on a spectacle.

These methods were cumbersome for the doctor and the patient and their reliability was not tested. The position of the patient's head in the cephalostat is significant as a faulty positioning can lead to diagnostic errors. The use of ear rods for positioning could result in transverse tilting of the head due to the asymmetry of the external acoustic meatus bilaterally. This is debatable as shown by Cooke and Wei [6] who noted no difference in NHP with or without ear rods. This could be resolved by having ear rods but only with very light contact.

The fluid level device introduced by Showfety et al., [4] was accurate and also easy to use and record the NHP reliably. However, in practice we encountered few twin difficulties of adhesive wear off and inability to control the position of the head transversely.

Our modification attempts to successfully deal with the twin problems by using an adjustable head strap that can be fully sterilized

thereby doing away with any issues of adhesive wearing off and infection control. We also use two fluid level devices; the additional fluid level is mounted on the patient's forehead to help control the transverse position of the head. The head strap double fluid level design makes it easier to record NHP. The true vertical is determined by a free weight hanging from a plumb line which appears on the radiograph as a radiopaque line. The limitations include lack of operator experience, patient cooperation and systemic and technical errors like magnification, exposure or mechanical fault.

CONCLUSION

As evidence based clinicians, we are now aware of the relationship between form and function and the importance of NHP in diagnosis and treatment planning. The proposed design offers a reliable and user friendly method to record NHP.

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