A Device To Standardize Facial Photographs In FH-Plane HOT (Horizontal Orientation Tool)

Dr. Suresh Gorantla[a], Dr. Rahul Kombathula[b],Dr. Kishore Tutika[c],Dr.Anil Chirla[d], Dr.Vizia Muddada[e]

Abstract

Aims and Objectives: The present study was done with an aim of taking facial photographs in a standardized manner to eliminate the intra observer errors and also to observe the reliability and repeatability of the same in successive visits.

Methods: A single individual of 23 years old was selected; photographed in NHP with mirror method and in FH-plane by orienting the head with the help of a specially designed device and a laser source (Bosch GLL 2X professional) by using a Cannon EOS 1300D DSLR camera for 25 times. Standard analyze the results using SPSS software version 22.0

Results: Standard deviation values are lower for laser group compared to NHP group in both profile and frontal photographs suggesting the laser technique for head positioning in FH-plane is better in reliability and repeatability than the NHP. Chi-square test suggesting that frontal photographs for both NHP, FH-plane is statistically significant while the profile groups are not statistically significant.

Conclusion: This method allowed us to take facial photographs of patients with head positioned such that the FH plane is parallel to the floor, which helps in standardization of photographs and superimposition with lateral cephalograms.

INTRODUCTION:

After the emergence of the soft tissue paradigm in orthodontics, orthodontic diagnosis and treatment planning based on dental and skeletal structures was replaced by orthodontic approaches built on the positive and negative characteristics of the facial soft tissues. With an objective evaluation of soft tissues an efficient treatment planning can be made, and the patient can be accurately assessed at the end of the treatment.

Very little attention has been given in orthodontic diagnosis and treatment planning regarding appropriate facial orientation during photographic recordings. Documentation of the treatment with pre-treatment and post-treatment photographs can be misleading if the facial orientation of patient is different in the successive photographs regardless of the time interval or treatment sessions. During photographing, patients frequently acquire an unnatural position, flexion or extension, which gives different results in diagnosis.

Analysis of facial profile using standardized photographs is valuable tool for orthodontic diagnosis. Many investigators oriented the subject's head in Natural Head Position (NHP). NHP is a standardized, reproducible position, with the head in an upright posture and eyes focused on a point in the distance at eye level such that the visual axis is horizontal(**Moorrees,1994**). But to take the photographs in NHP there should be trained technicians during orthodontic examinations(**Adriana Likes Pereira et.al. 2010**).

The advantage of FH plane is that it can be projected onto the patient's face and the patient can be oriented to this plane in a standardized manner in successive visits. There are studies, which suggests that FH plane is closely oriented to NHP among all the horizontal reference planes (**Burstone, 1958)**,(**Divya shetty et al. 2013**).

We have conceptualized on a novel method to position the patient's head with Frankfort's Horizontal (FH) plane parallel to the floor by a specially fabricated device.

Aims and Objectives:

The present study was done with an aim of taking facial photographs in a standardized manner to eliminate the intra observer errors and also to observe the reliability and repeatability of the same in successive visits.

Materials and Methods:

A 23-year-old individual from Srikakulam, Andhra Pradesh was selected. Authorized participation was taken from the participants by signing terms of informed consent.

Equipment used:

Horizontal Orientation Tool (Figure 1)-A portable device was fabricated, consisting of a metal framework to which a self-leveling cross line laser source (Bosch GLL 2X professional) was mounted. This whole assembly was mounted on a sliding rack, which can be vertically adjusted and locked into any position with the help of screws, according to the height of the patient. The laser line was projected on the patients face.

a- Professor and HOD, Department of orthodontics, Sree Sai Dental College And Research Institute, Srikakulam.
b- Postgraduate, Department of orthodontics, Sree Sai Dental College And Research Institute, Srikakulam.
c- Postgraduate, Department of orthodontics, Sree Sai Dental College And Research Institute, Srikakulam.
d- Professor, Department of orthodontics, Sree Sai Dental College And Research Institute, Srikakulam.
e-Senior lecturer, Department of orthodontics, Sree Sai Dental College And Research Institute, Srikakulam.

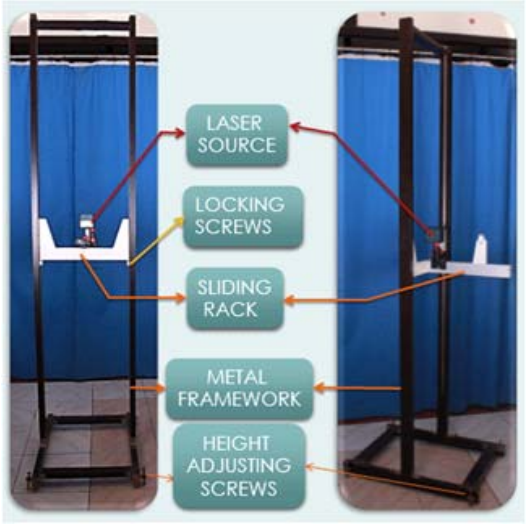

Fig.1 Horizontal Orientation Tool

This assembly was placed behind and adjacent to the camera at a distance of 100cm from the patient to avoid its interference in field of interest during photography.

Laser source(Figure 2)-Bosch GLL 2X professional, a self-leveling cross line laser source was used with the specification of class II (<1mW) laser which is not considered to be hazardous if viewed for any period of time less than or equal to 1000 seconds and causes human eye blink reflex within 0.25 seconds of exposure avoiding eye damage.

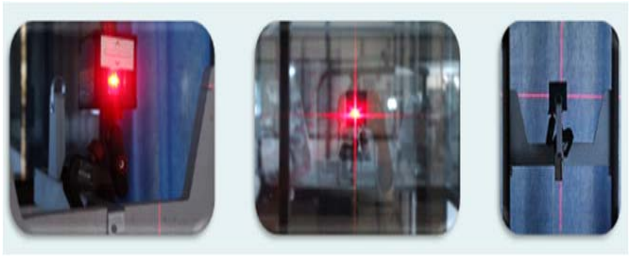

Fig.2 Laser source

Camera (Figure 3A) -A DSLR camera (Cannon EOS 1300D model) with 18-55mm zoom lens set at 55mm in MANUAL MODE, aperture value of F11 and shutter speed adjustment at 1/60th of a second was positioned on a tripod at a distance of 90 cm from the patient. All the photos were taken with the height of the camera adjusted such that the center of the camera lens coincides with the subnasale of the subject (Figure 3B).

Fig.3a Camera

Fig.3b Focus point

To eliminate the shadows, two auxiliary light sources were setup in separate boxes on respective metal supports (Figure 4).

Fig.4 Auxiliary light sources

As a background for the photographs, a negatoscope was used which ensured a neutral background and a black cotton string (0.5 mm thick) was attached to the negatoscope with a plumb. This string was used as the vertical reference line (VL)(Figure 5).

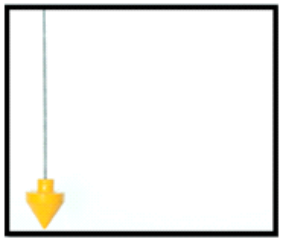

Fig.5 Negatoscope with plumb

Head positioning:
Two methods were followed; natural head position method and FH plane orientation method

1. Natural head position(Figure 6): the patient was asked to view a distant object at their eye level.

Fig.6 NHP method

1. FH plane orientation: Patient's head was positioned such that:

a. Projected horizontal laser line(Figure 7A)co-ordinates with the FH plane, which ensures that the photographs achieved have FH plane parallel to the floor.

b. Projected vertical laser line(Figure 7B)was focused on mid-sagittal planes, which helps in eliminating unwanted lateral head-tilts.

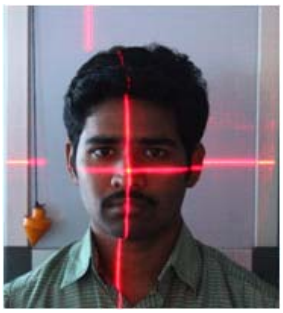
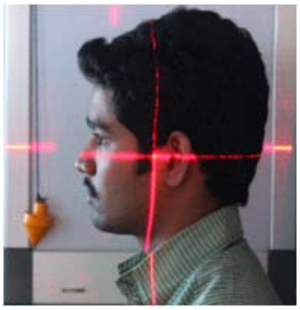

Fig.7a Frontal view with laser Fig.7b profile view with laser

Protocol for taking photographs:

Sequence of photography session for each set of photographs:

· The patient was positioned in this set-up with the natural head position (NHP) of the patient. Once the patient was stabilized in this position the first set of photographs were taken in both frontal (NHP-Frontal) and profile(NHP-Profile) views.

· After positioning in this set-up the laser was projected onto the patients face. The tilt of the head was adjusted such that the projected line coincides with the FHP of the patient and the second set of photographs were taken in both frontal (Laser-Frontal) and profile (Laser-Profile) views. The line was not visible on the photograph because of the flash (Figure 8A, Figure 8B).


Fig.8aFrontal view with flash Fig.8b Profile view with flash

· Another 24 sets of photographs were taken after 15 days for the same patients using the same protocol.

The digital photographs were unaltered and printed. The angles for frontal and profile views were manually measured by a single operator for all groups to check for the reliability and repeatability of the methods employed (Table 1). The angular measurements taken were:

a) Frontal view: Angle between vertical line and the line joining outer canthi was measured (Figure 9A)

b) Profile view: Angle between the VL (vertical reference line) and soft tissue line Ls – Pog (upper lip – tegumentar pogonium) was measured (Figure 9B)


Fig.9a Frontal angle Fig.9b Profile angle

Appropriate statistical analyses of the results were performed on all data sets with the SPSS version 22.0; Chi-square test was done to compare the inter group variability and Paired t-test was done to compare the intra group variability. Statistical significance was established at the $p<0.05$ levels.

TABULATING THE VALUES:

Table 1 **Angular measurements**

S.No.	NHP-FRONTAL	LASER-FRONTAL	NHP-PROFILE	LASER-PROFILE
1	92	90	17	20
2	90	88	20	19
3	92	90	15	22
4	90	90	18	20
5	91	90	18	20
6	92	89	20	21
7	90	90	17	20
8	90	90	17	21
9	91	90	19	24
10	91	88	20	21
11	90	89	17	20
12	91	87	18	20
13	90	90	17	19
14	90	88	17	23
15	89	90	21	25
16	87	89	19	23
17	90	88	18	22
18	90	90	21	22
19	91	90	19	19
20	90	90	20	24
21	90	89	15	24
22	90	89	16	21
23	90	88	19	22
24	90	90	17	22
25	90	90	15	19

Statistical Analysis:

Paired Samples Statistics:

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	NHP-Frontal	90.2800	25	1.02144	0.20429
	LaserFrontal	89.2800	25	0.93630	0.18726
Pair 2	NHPProfile	18.0000	25	1.77951	0.35590
	Laser Profile	21.3200	25	1.77294	0.35459

Table 2 **Paired Samples Statistics**

- Among frontal view groups :
- Standard deviation was lesser for Laser group
- Among profile view groups :
- Standard deviation was lesser for laser group.

Laser groups showed lesser standard deviation compared to the NHP groups

Chi-squareTest:

	NHP-Frontal	Laser-Frontal	NHP-Profile	Laser-Profile
P value	0.000*	0.002*	0.414	0.549

Table 3 **Chi-square Test**

*Statistically significant (p-value <0.05)

A. Among frontal view groups:

· NHP group has the highest significant difference (p=0.000)whereas Laser group has the least (p=0.002)

B. Among profile view groups:

· No statistically significant difference was found among the NHP and laser groups

Paired Sample t Test:

	Correlation	P-Value
NHP Frontal – Laser Frontal	0.830	0.001*
NHP Profile – Laser Profile	0.281	0.000*

Table 4: **Paired Sample t Test**

*Statistically significant (p-value <0.05)

Results:

· *Frontal Group*

o When NHP and laser groups were compared the p-value was statistically significant (p=0.001)

o Correlation between NHP and Laser groups showed a value of 0.830

· *Profile Group*

o When NHP and Laser groups were compared the p-value was statistically significant (p=0.000)

o Correlation between NHP and Laser groups showed a value of 0.281

o Higher p value (p=0.001), higher correlation co efficient value(0.830) and higher standard deviation for profile values compared to frontal values suggests that the repeatability in frontal is better than profile.

o As the standard deviation values are lower for laser group compared to NHP group in both profile and frontal photographs it can be suggested that the laser technique for head positioning is better in reliability and repeatability than the NHP.

Discussion:

The importance of standardization of facial photographs is justified by the fact that facial analysis is essential to orthodontic diagnosis (**Arnett and Bergman,1993)**. According to Moorrees(**Moorrees,1994**),little attention has been given in orthodontic publications regarding the appropriate facial orientation during photographic recording. In some cases, patients with Class II malocclusion are documented before treatment with the head tilted down and after treatment with the head tilted up in order to highlight the correction of mandible retrognathia (**Adriana Likes Pereira et.al, 2010**).

Natural head position as a craniofacial reference system has been advocated because of its good intra individual reproducibility, however its use is not widespread perhaps due to practical ent and s aff training.

The Frankfurt horizontal plane (parallel to soil) is the most commonly used reference for positioning patients during photographic or

Among all the reference planes studied, the Frankfort horizontal plane was closest to the true horizontal and thus could be recommended as a reference plane, when radiographs were not recorded in natural head position (**Divya shetty et al. 2013**).Frankfort horizontal plane can be ion and orbitale and can be reprodu

It would be beneficial to take both lateral cephalograms and facial photographs with the head positioned along the FH plane so that it will be easier to superimpose the lateral cephalograms and facial photographs and can perform facial analyses. So we have devised this horizontal orientation tool to orient the head with FH plane parallel to the floor. As seen in our study this tool helps to take standardized facial photographs with minimal variability in successive visits.

Conclusion:

· This method allowed us to take facial photographs of patients with head positioned such that the FH plane is parallel to the floor.

· Different chin positioning in natural head position by the same patient causes differences in measurements, which could be eliminated by standardizing the head position in FH plane.

· Facial photographs taken with orientation of patient's head using FH plane as a reference plane can simulate the same position as that of the cephalometric radiographs and hence preferable for superimposition.

This device can be further improved with the use of a class I LASER instead of the Class II LASER (Bosch GLL 2X professional) which was used in this study, as class I LASER is absolutely safe.

REFERENCES:

1. Adriana Likes Pereira, Luciana Manzotti De-Marchi, Paula Cabrini Scheibel and Adilson Luiz Ramos,2010.Reproducibility of natural head position in profile photographs of children aged 8 to 12 years with and without the aid of a cephalostat, *Dental Press J. Orthod*,15: 65-73.
2. Arnett GW, Bergman RT, 1993. Facial keys to orthodontic diagnosis and treatment planning, *Am J Orthod Dentofacial Orthop*,103:299-312.
3. Burstone CJ,1958.The integumental profile,*Am J Orthod Dentofacial Orthop*,44:1-25.
4. Coenraad F. A. Moorrees, 1994. Natural head position - a revival, *Am J Orthod Dentofacial Orthop*,105:512-3.
5. Divya Shetty, Dinesh Kumar Bagga, Sandeep Goyal, Payal Sharma,july-september 2013. A cephalometric study of various horizontal reference planes in Natural Head Position, *The Journal of Indian Orthodontic Society*,47(3): 143-7.
6. Viazis AD, march 1991. A cephalometric analysis based on natural head position,*J Clin Orthod*25:172-181.