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ORIGINAL ARTICLE

Comparison of Conventional And Digital Cephalometric For Airway Evaluation: A Cross-sectional Study

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***ABSTRACT*:**

Aim: One of the most commonly used diagnostic tools in Orthodontics is a lateral cephlogram. The study was undertaken to compare the linear measurements of the pharyngeal spaces recorded on a lateral cephlogram manually and digitally on a 2 D lateral cephalogram. **Material & methods:** After going through 361 records, a total of 48 subjects (ages 14–33 years) were included, out of which 20 were male subjects and 28 were female subjects. The measurements were made on the digital lateral ceohalogram and recorded. The said landmarks were identified on the Digital Lateral cephalogram and the values were calculated and the lateral cephalograms were manually traced upon an A4 size acetate paper .Total of 4 parameters were taken in the study. SPSS (Version 16.0) and Microsoft Excel software were used to carry out the statistical analysis of data. Data was analyzed with the help of descriptive statistics viz., mean and standard deviation and presented by bar diagrams. Student's independent t-test was employed to test the differences between males and females. A P-value of less than 0.05 was considered statistically significant. Results: None of the parameters used for comparison in conventional and digital cephalometric study showed statistically significant difference. **Conclusion:** According to this study, is reasonable to conclude that the manual and digital tracings of the airway show the no statistically significant difference.

Key words: Lateral Cephalogram, Digital Lateral Cephalogram , Manual Tracings, Airway Analysis.

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INTRODUCTION

Pierre Robin, an early worker in this area, is best remembered for the cleft palate syndrome with glossoptosis that bears his name. He believed that a retrognathic mandible held the tongue back, thus restricting the respiratory airflow and leading to pathologic sequelae. Robin[1] designed the monobloc appliance, which repositioned the mandible and tongue anteriorly to enlarge the airway. This approach is experiencing a revival in the treatment of snoring and obstructive sleep apnoea syndrome[2,3,4,] especially as a retrognathic mandible is often implicated.[5,6,]

The size of the nasopharyngeal airway space is of importance in its relationship to the morphology of the face, the mandible included, because with reduction of the nasopharyngeal airway space nasal breathing becomes difficult or impossible, and mouth breathing becomes necessary. It is with chronic mouth breathing that the normal balance of oral and paraoral structures is upset and changes of both structures can be expected. The width of the nasopharynx is also thought to be stable after age two years; however, the vertical dimension of the nasopharynx continues to increase until age seventeen to eighteen years[7].

One of the most commonly used diagnostic tools in Orthodontics is a lateral cephlogram. Recently, digital cephlometry has aided in the evaluation and treatment planning of the patient and acted as a diagnostic instrument in this area. The generated image by digital cephlogram is isotropic and linear and angular measurements are reliable and anatomically accurate. However this technology is not as available as conventional radiographs. There is an huge debate on how the digital images are more accurate than the manually traced lateral cephalogram. So, keeping this in view, it was decided to undertake a study to compare the linear measurements of the pharyngeal spaces recorded on a lateral cephlogram manually and digitally on a 2 D lateral cephalogram .

The aim of the study undertaken was to compare pharyngeal spaces measurements on manually traced lateral cephalogram and a digital lateral cephaloagram.

MATERIAL AND METHODS

Pre-treatment lateral cephalometric radiographs and CBCT were selected from Out Patient Department of the Department of Orthodontics & Dentofacial Orthopaedics, Government Dental College & Hospital, Srinagar, between 2012 and 2015. After going through 361 records, a total of 48 subjects (ages 14–33 years) were included, out of which 20 were male subjects and 28 were female subjects. All subjects met the following **inclusion criteria:** ANB 1-5 degree, Over 14 years of age, No history of orthodontic treatment, Breathing comfortably through the nose, No wound, burn or scar tissue in the neck region, No deglutition disorder or visual or hearing disorder. And the following **exclusion criteria**: Subjects with cleft lip and palate, Subjects with history of chronic mouth breathing, snoring and tonsillectomy, Subjects with missing first molars.

To have standardized cephalometric radiographs, it became important that all the radiographs were taken

from the same X-ray machine with the subjects in the natural head position, with teeth in maximum intercuspation and lips at repose. All the lateral cephalometric radiographs were taken by the same operator from the standardized Orthophos XG5 DS CEPH (SIRONA) on a standard Konica Minolta 8 × 10 inch film with an anode to mid subject distance of 5 feet by the same operator. Natural head position was obtained by asking the subject to look straight ahead such that the visual axis was parallel to the floor. Thyroid shield and lead apron were worn by the subject to reduce radiation exposure. All the films were exposed with 64 KVp, 8 mA and an exposure time of 9 seconds. A sample of 48 lateral cephalograms was taken. The measurements were made on the digital lateral ceohalogram and recorded. The said landmarks were identified on the Digital Lateral cephalogram and the values were calculated and the lateral cephalograms were manually traced upon an A4 size acetate paper with a 3HB hard lead pencil over well-illuminated viewing screen by the same operator to avoid the intra operator bias. The linear measurements were recorded with a measuring scale up to a precision of 0.5 mm.

Fig. 1: Armamentarium used for study.

Planes and Parameters used:
A total of 4 parameters were undertaken in the study .They are as follows:
1. SPAS, superior posterior airway space *(width of airway behind soft palate along parallel line to Go-B line)*
2. MAS, middle airway space*(width of airway along parallel line to Go-B line through P)*
3. IAS, inferior airway space *(width of airway space along Go-B line)*
4. VAL, vertical airway length *(distance between PNS and Eb)*

Landmarks undertaken in the same are as discussed below.

- Eb: Base of the epiglottis
- P: Tip of the soft palate
- PNS: Posterior nasal spine
- Me: Menton
- Go: Gonion
- B: point B
- RGN: Retrognathion

SPSS (Version 16.0) and Microsoft Excel software were used to carry out the statistical analysis of data. Data was analyzed with the help of descriptive statistics viz., mean and standard deviation and presented by bar diagrams. Student's independent t-test was employed to test the differences between males and females. A P-value of less than 0.05 was considered statistically significant.

Table 1: Mean, Standard deviations and P values for sex differences

Variable		Males		Females		Total		P-value for sex difference
		Mean	SD	Mean	SD	Mean	SD	
Airway	SPAS	11.24	3.51	11.07	2.67	11.15	3.09	0.105
	MAS	10.90	3.29	9.27	2.36	10.08	2.75	0.649
	IAS	11.24	4.18	10.01	2.63	10.62	3.34	0.428
	VAL	60.10	7.21	59.37	5.88	59.67	6.40	0.693

***P-value<0.05, **P-value<0.01, ***P-value<0.001**

Table 2: Mean, Standard deviation and P values for manual and digitally traced Lateral Cephalograms

Variable		Manual		Digital		Total		P-value
		Mean	SD	Mean	SD	Mean	SD	
Airway	SPAS	12.37	4.48	12.04	3.26	12.22	3.92	0.768
	MAS	10.41	2.90	11.21	2.32	10.78	2.65	0.285
	IAS	12.56	4.66	12.83	3.84	12.69	4.25	0.819
	VAL	61.11	6.59	60.75	7.08	57.65	7.71	0.721

***P-value<0.05, **P-value<0.01, ***P-value<0.001**

DISCUSSION

The conventional cephalometric analysis is performed by tracing radiographic landmarks on acetate overlays and measuring linear and angular values. However, despite its widespread use in orthodontics, the technique is time-consuming and has several drawbacks, including a high-risk of error in tracing, landmark identification, and measurement. Cephalometric errors can be divided into those related to the acquisition, identification, and technical measurement. Reproducibility of measurements by the operator is also a significant factor in determining the accuracy of any method of analysis. [8]

The use of computers in treatment planning is expected to reduce the incidence of personal errors due to operator fatigue and provide standardized, fast, and effective evaluation with a high rate of reproducibility. With the rapid evolution of computer radiography, digital tracing has slowly replaced the manual tracing methods. The use of both digital radiography and conversion of manual film to a digital format offers several advantages - it is easy to use, allows several analyses to be performed at a time, promises convenience when generating treatment predictions, takes up less storage space, allows superimposition of images, provides the option to manipulate the size, and contrast of the image; and provides the ability to archive and improve access to images to overcome the problem of film deterioration, which has been a major source of informations loss in craniofacial biology. [9]

Landmark identification is greatly affected by operator experience, which might be as important as the tracing method itself. Because interoperator error has in general been found to be greater than intraoperator error as stated by Sayinsu *et al*. [10] to minimize the error all measurements in this study were carried out by one examiner.

In this study, the analysis of the results obtained when comparing the airway cephalometric measurements taken in digital and manual tracings revealed values that showed no statistically significant differences.

CONCLUSION:

According to this study and the results achieved by comparing measurements obtained by airway analysis using manual and digital tracings it is reasonable to conclude that the manual and digital tracings show no statistical significant difference, so either of the technique can be used for evaluation of cephalogram.

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