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Cephalometric Landmark Identification by Conventional and Digital Direct Radiography in Skeletal Class II Individuals

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ABSTRACT

Background. In this study manual and computerized tracing was done to evaluate comparative analysis of skeletal class II parameters using a Nemo tech software.

Material and Method: Skeletal class II patient were evaluated for the analysis of sagittal parameters. 10 patient were evaluated and pretreatment digital cephalometric radiographs were taken together. Nemotechsoftware was used for computerizing tracing and manual tracing was done using 3H pencil.

Result: All the data were subjected to statistical analysis and paired t test was used at level of significance($p > 0.05$). Results finding the some cephalometric measurement were reproducible with manual traced radiograph and by computerized software. The assessment of intraobserver reproducibility showed an excellent Intraclass Correlation Coefficient (ICC) in both methods.

Conclusion: According to the finding of the study the new NX software advantageous to produce digital image achieving, transmission and enhancement of diagnosis in orthodontics.

Keywords: Cephalometry, results reproducibility, radiography, computerized.

INTRODUCTION

Making diagnosis properly, using various treatment options, and the operator's skills are helpful in success of orthodontic treatment and patient satisfaction. Cephalometric tracing and various diagnostic techniques are essential to make proper diagnosis in orthodontics. The most ancient techniques used in cephalometric tracing involves analysis of various points, which are located on skull, using them various angles and planes are derived. Various study demonstrated the comparison of various points and tends to established various correlation of given values with different analysis. Digital radiography are advantages like easily storage, reproducibility, rapid development of image and digitally images[4,6].

Number of studies have been done to identification of various landmarks in conventional and digital radiography, to check reproducibility of landmarks identification in digital radiography when compared with conventional radiography[7].

Recently, Bonilla et al[12] did a study and determined the reproducibility of 14 hard tissue cephalometric points; a program that allows landmark identification on a computer screen directly with the cursor. They used a sample of 22 films, 11 digital and 11 conventional radiographs, each pair taken on the same patient and with the same equipment; they took the digital radiograph first and then the conventional one. They found out that all points show similar

reproducibility in both types of radiographs, except for these points: infraorbital, posterior nasal spine, joint, porion, and basion, with direct digital image presenting the lowest interobserver error. In another study, Sandler reported that joint and gonion are the points with the most reproducibility by manual tracing.

Few studies determine reliability in identifying soft tissue landmarks.[14] Wisth and Böe claim that soft tissue measurements depend on the quality of conventional cephalometry more than hard tissue measurements. Also, Hagemann et al report that reproducibility of pronasal and pogonion in soft tissues is better in digital imaging than in conventional radiography. On the other hand, Dvortsin, et al by comparing manual tracing in a 1:1 printing with Viewbox in soft tissues, noted that the area around the stomion was the least reproducible, and although small statistically significant differences were found, the clinical relevance of these findings is questionable[3,2].

Given the limited information found in the literature, the goal of this study was to evaluate the reproducibility of soft tissue cephalometric landmark identification using direct digital radiography and conventional radiography[9].

METHODS

Pretreatment lateral head digital radiographs were taken of 10 patients which were selected among the class 2 individuals in the department of orthodontics and maxillofacial orthopedics. Following wereinclusion criteria for selection of individuals.

1. All the pt. selected were age of 15-21 years old were included in study.
2. All patient were with erupted with permanent dentition.
3. All patient face were apparently symmetrical.

A digital cephalometer was used for taking radiograph in natural head position by a trained operator. A computer was used connected with key board and a mouse. A scanner of EpsonPerfectionv700 dual scan system was attached with this computer. A Nemoceph software used for analyzing the process of transferring of image as well as for tracing the lateral cephalometric image which is obtained digitally. A 3H pencil were used for tracing conventional radiograph for with a clear acetate overlay. Soft tissue and hard tissue points were marked which were selected in mind as they were directly located. A printer was used for printing the digital image.[10]This was a concordance study on 11 direct digital lateral radiographs used in a previous study by Bonilla et al;[1] the radiographs were taken by orthodontic students once informed consent was obtained. The radiographs were taken in natural head position by a trained operatorSoft tissue points were selected bearing in mind that they are directly located, i.e., they are constructed points, so it was not necessary to draw anatomical structures, which are usually operator-dependent, thus allowing bias control during the study; these points were: labralesuperius (Ls), labraleinferius (Li), subnasale (Sn), glabella (G'), columella (Cm), menton (Me), pogonion (Pg'), stomionsuperius (Stms), stomioninferius (Stmi), and lower vermilion (Vmi).

These cephalometric points were directly located on images displayed on a 14-inch Lenovo monitor with a mouse, a program designed for a previous study.[1] After recording each cephalometric point with the mouse, the monitor image indicated their position.. All the data were subjected for statistical analysis.

As for dispersion, recorded according to standard deviation data—which was considered in this study as a more reliable measure of reproducibility— statistically significant differences were found in the labralesuperius, subnasale, columella, stomionsuperius, and stomioninferius on the X axis, and greater reproducibility was found in digital radiography. In terms of Euclidean distance, labraleinferius and stomionsuperius were more reproducible in digital imaging, which was more precise and accurate. The lower interobserver dispersion error in digital imaging may be explained because these radiographs show greater sharpness and contrast in gray scale[11].

In the present study, ICC was used to assess intraobserver reproducibility in each of the three observers; we obtained a value which was a great result, similar to that reported in other studies.[11] these results indicate a high level of measuring accuracy thanks to proper training of the observers; therefore, the found differences are attributed to the evaluated methods only[13].

The development of cephalometric tracing software has provided orthodontists with new possibilities because they allow manipulating image quality for greater clarity especially in soft tissues, but few studies have compared the location of cephalometric points and measurements soft tissue in digital and conventional images—which limits the comparisons of the present study[14].

Table-1: comparison of group for skeletal reading (T-test)

	Conventional hand tracing		Nemotec dental studio NX		
Skeletal parameters	MEAN	S.D	MEAN	SD	P- VALUE
Effective mandibular length	118.44	5.67	1119.98	8.23	.79
effective max length	98.00	6.01	98.01	5.02	.019
maxillofracial difference	23.34	7.32	23.95	7.31	.91
n per a	2.5	4.33	2.44	4.44	.45
N per. toPog	-4.44	7.9	-5.55	8.88	.23

Table.-2: intra class correlation coefficient for skeletal parameter intra examiner reproducibility

	Conventional hand tracing	Nemotec dental studio NX
Effective mandibular length	.82	.97
effective max length	.92	1.5
maxillofracial difference	.37	.39
n per a	.99	.91
N per. to Pog	.90	.99

Table-3: comparison of the groups for dental measurements using a paired t- test

Dental measurement	Conventional tracing		Nemotec Dental studio NX		
	MEAN	SD	MEAN	SD	P-VALUE
Canine relation	2.32	3.89	3.6	.51	.00
Incisalover jet	7.64	3.4	4.3	3.5	.08
Incisal overbite	2.67	4.8	7.89	4.52	.17
Molar relation	--.20	2.62	.005	3.11	.330
Upper molar position	19.5	2.99	22.2	4.15	.006
Upper incisor to pt. A	10.5	5.50	9.54	2.41	.135
Upper molar position	20.20	4.77	22.20	5.12	.006

Table-4: difference in cephalometricsmeasurement generated by manual and digital cephalometric analyzing methods by two examiners analyzing methods by two examiners analyzedusing independent t- test for dental parameters.

Dental measurement	Examiner 1		Examiner 2		P value (statistically significant <0)
	Mean	S.D	Mean	S.D	
Canine relation	2.06	3.87	3.5	.41	.00
Incisal over jet	4.7	3.4	4.3	3.4	.09
Incisal overbite	5.7	4.8	5.89	4.52	.17
Molar relation	--.23	3.53	.005	3.16	.220
Upper molar position	21.1	4.89	20.2	6.16	.006
Upper incisor to pt. A	8.11	5.49	9.54	4.41	.13
Upper molar position	21.10	4.87	20.10	5.12	.006

DISCUSION

Analysis of all the patient were taken out. Furthermore inter observer error, an independent examiner carried out all the analysis manually as well as digitally for 10 radiographs.

Tabel-1 shows the comparison of hand traced and digital reading of class 2 pattern using paired t test. Statically significant difference were found in maxillary length and maxilla mandibular differential. Table -2 shows intra class coefficient was calculated to determined inter-examiner reproducibility.The highest and lowest correlation parameters were same for both digital and manual methods. In some studies the intra examiner and intrexaminer variations in training and experience and by the nature of landmarks identification. This software does not allow to draw various reference planes during landmarks identification on the monitor displayed image during landmarks identification. There is a point which is selected as arbitrary point called as gnathion. Canine relation showed statistically significant difference between manual and digital methods. Canine relation has not been particularly investigated by the software. As on the basis of this measurement with this software canine relation was not clear hence the draw backs of canine of using this software.

The points A and B are more reliable points when compared to manual methods when located landmarks defined as being more inferior or deep in a given bone contour. Santoro et al conducted a study Compared manual and computerized method found difficulties in locating Cd. Go, Sn. As many reference plane may be drawn with manual tracing but with this computer software planescannot be drawn. In order to reduce the error during tracing acc. to chen et al porion and orbitale showed statistically significant difference between manual and digital methods[1]. Most of differences in the means of cephalometrics data showed by manual and digital cephalometrics analyzing methods by two examiners analyzed were statistically insignificant except for incisor over jet, and for upper incisor protrusion. Table -3 compared the manual and digital methods for dental measurement. Paired t test was used to compare the two parameters. Statistically significant difference was observed for the canine relation and upper molar position (.006).
In the present study difference between measurements of sagittal parameter showed larger difference[4,7]. The difference was from calibration. Effective maxillary and mandibular difference showed statistically significant difference between parameter. In order to eliminate error due to magnification, the present study was based on digital radiograph rather than scanned images. Moreover, because it was not possible to use a sandwich technique in which digital and conventional radiograph are obtained simultaneously conventional measurement were taken using hard and copy printout of the digital radiographs. Any investigation aiming to demonstrate the accuracy of digital cephalometrics should focus on several significant factors, such as the use of measurements instead of landmarks, source of error, sample collection[8]. In the study, the use of measurement was preferred to landmark identification because measurements are the end product of the cephalometric tracing process and provide data for treatment planning. Although early studies investigated landmarks identification, recent research had focused on cephalometric measurements[7].

CONCLUSIONS

The study demonstrated the reliability and reproducibility of skeletal and dental parameter used in class 2 patient using digital and manual radiography.

Pretreatment of 10 patient with natural head position were traced and using conventional and digital radiography. Using Nemotec software and a hand traced radiograph were compared. All the data were used and paired t test was applied. Using conventional measurement with digital studio NX Software the validity and reproducibility with conventional method are highly correlated. The new NX software advantageous to produce digital image achieving, transmission and enhancement of diagnosis in orthodontics.

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