ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

The Comparison of Computer Aided Digital Cephalometric Radiograph with Manual Tracing

Dr. Hardik Lalakiya, Dr. Baswaraj, Dr. Chintan Agrawal, Dr. Utpal patel, Dr. Arpit Ramani, Dr. Vinali Patel, Dr. Sandeep Chaudhary

Manuscript Info

Manuscript History:

Received: 15 November 2015
Final Accepted: 22 December 2015
Published Online: Janaury 2016

Key words:

Manual Tracing, Facad software, Cephalometric measurements.

Corresponding Author

Dr. Hardik Lalakiya

Abstract

AIM & OBJECTIVES**:** To evaluate and compare the reliability of landmark identification between computer aided digital cephalometric radiographs using 'facad' software and hand tracing of digital cephalometric radiographs

MATERIALS AND METHODS: Sixty digital pre-treatment lateral cephalometric radiographs were randomly selected from the patient's record room at the Department of Orthodontics and Dentofacial Orthopaedics Narsinhbhai Patel Dental College and Hospital, Visnagar, Gujarat. Landmarks were identified both in manual and digitized tracings. 8 Linear and 10 Angular measurements were calculated from the co-ordinates of cephalometric landmarks and comparison done. All the lateral cephalograms were scanned at 300 dpi with scanner with transparency adapter and digitized onscreen. The digital radiographs were manually traced and digital images were transferred to a computer, using a FACAD program. The results were then tabulated in Microsoft excel the level of significance (p-value) was 0.05. Paired t-test was performed using SPSS software 22 for comparison between tracing done by manual method and by Facad Software.

RESULTS: A comparison of both methods showed statistically significant differences only for six out of eighteen measurements. These were facial angle, occlusal plane to SN angle, interincisal angle, cant of occlusal plane, Go – Gn to SN angle and Ar – Go plane. Thus it can be concluded that digital tracing with Facad Software is efficient for clinical purposes and comparable with manual cephalometric tracings.

CONCLUSION:

From these results we can conclude that both Linear and Angular measurements were accurate and reliable. Except, few measurements showing highly significant differences, the validity of the measurements with the Facad software and with the conventional method are highly correlated.

INTRODUCTION

For more than seven decades, cephalometry has been one of the main diagnostic tools available to the orthodontist. Cephalometric norms were published by prominent clinicians and researchers, and are used for diagnosis, treatment progress, posttreatment evaluation, and research. In orthodontics, cephalograms are the crucial diagnostic component. It is essential for correct treatment assessment and later for the evaluation of the therapy.[1]

The major sources of error in cephalometric analysis include radiographic film magnification, tracing, measuring, recording, and landmarks identification.

In contemporary orthodontics, lateral cephalograms are used for the assessment of treatment changes induced by the appliances used. Therefore, it is important to keep the method error to a minimum in order to see the valid small changes achieved by treatment.[2]

Considering the importance of cephalometric analyses for orthodontic diagnosis, the accuracy of computer – based tracing software must be established by comparing them to hand tracing on acetate paper, the current gold standard.[3]

The aim of this study was to compare the accuracy of cephalometric measurements made with digital tracing software (FACAD®) with equivalent hand-traced measurements, and to evaluate the reproducibility of each method.

Materials and Methods

Sixty digital pretreatment lateral cephalometric radiographs were randomly selected from the patient's record room of Department of Orthodontics, Narsinhbhai Patel Dental College and Hospital, Visnagar, Gujarat.

Methodology

Digital Lateral Cephalometric radiographs were collected from Department Of Orthodontics And Dentofacial Orthopedics at Narsinbhai Patel Dental College and Hospital, Visnagar, Gujarat. After obtaining the soft copy of the lateral cephalogram was imported to the software facad. The aim of this investigation was to compare the classic method of tracing by hand with computerized method, where the lateral cephalograms were scanned at 300 dpi with scanner with transparency adapter and digitized onscreen

At the time of scanning, a transparent ruler was placed adjacent to the cephalogram. The ruler was kept to assess the magnification errors during the process of scanning. Image thus acquired was stored in Joint photographic experts' group (jpeg) format. The cephalometric measurements were done using two methods which are as follows.

1. Cephalometric measurements using the manual method.
2. Cephalometric measurements using Facad software

The linear and Angular measurements used in the study are listed in the statistical table

Fig 1 Linear Measurements – By Facad

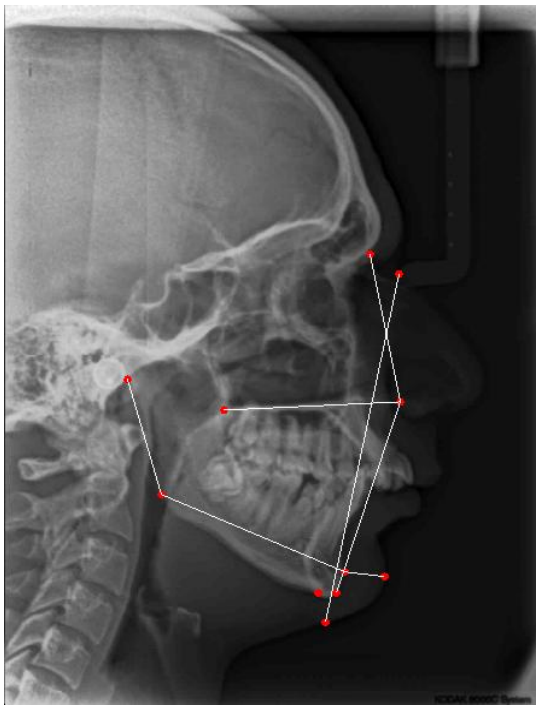


Fig 2 Linear Measurements - Manually

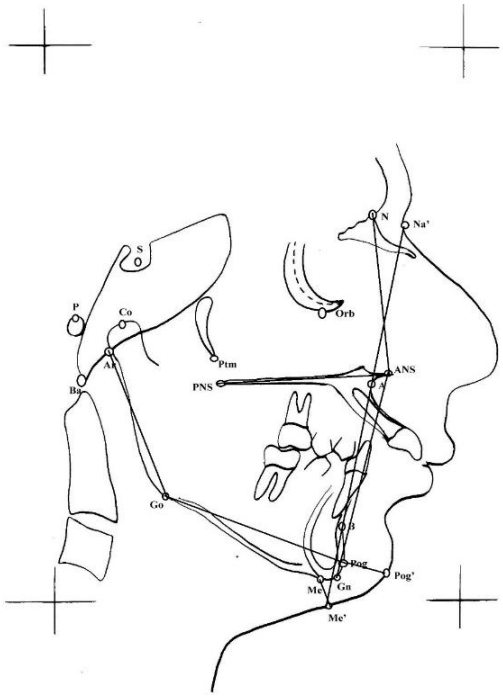


Fig 3 Angular Measurements – Manually

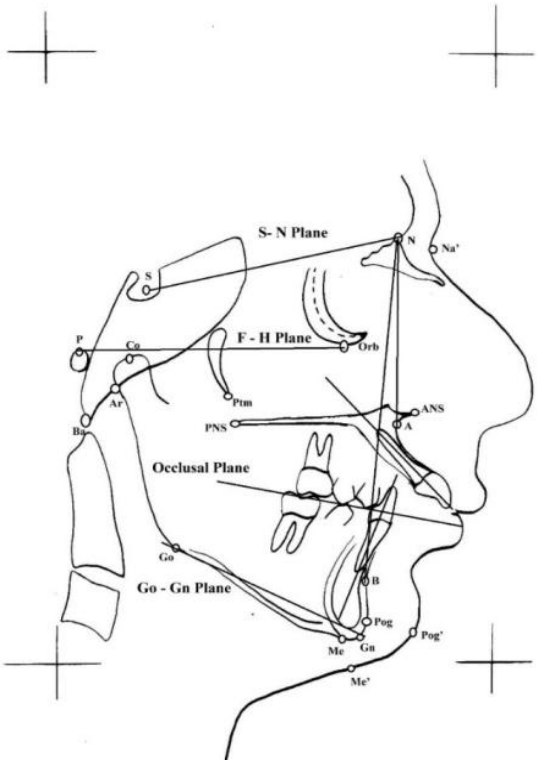
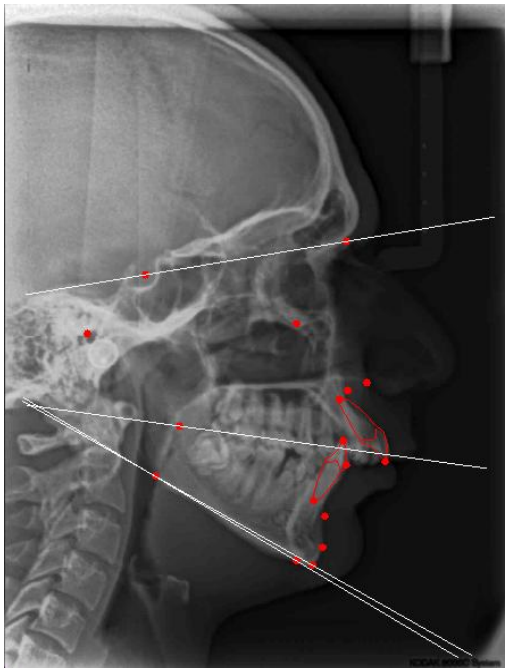


Fig 4 Angular Measurements - By Facad

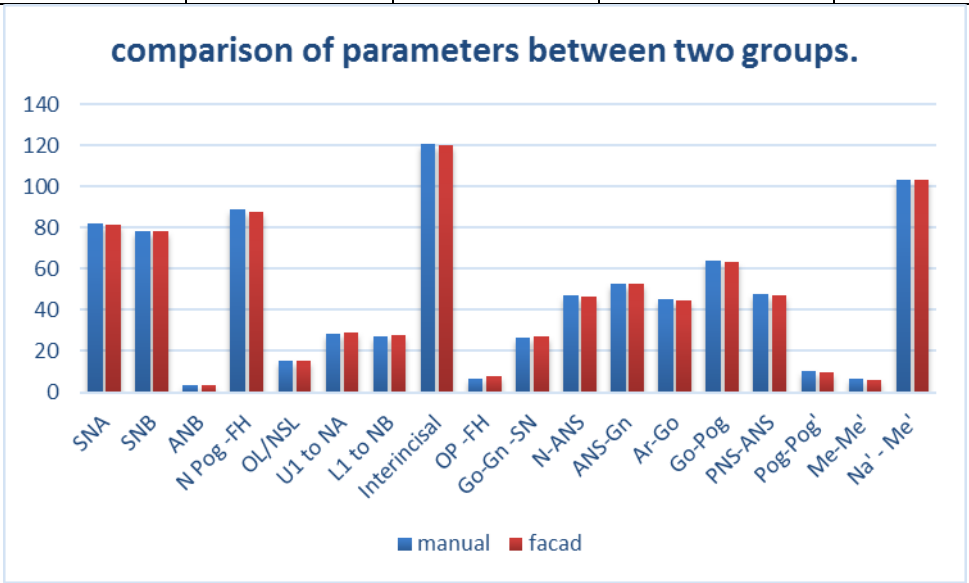


STATISTICAL ANALYSIS

The results were then tabulated in Microsoft excel. The level of significance (P value) was 0.05. Paired t-test was performed using SPSS 22 software for comparison between tracing done by manual method and by Facad Software.

parameter	manual	facad	mean difference	p value
SNA	81.842	81.757	0.085	0.111
SNB	78.542	78.602	-0.06	0.138
ANB	3.308	3.157	0.151	0.47
N Pog -FH	88.808	87.937	0.871	0.008
OL/NSL	15.217	15.023	0.194	0.003
U1 to NA	28.3	28.978	-0.678	0.221
L1 to NB	27.067	27.543	-0.476	0.171
Interincisal	121.092	120.317	0.775	0.017
OP -FH	6.387	7.63	-1.243	0.006
Go-Gn -SN	26.508	26.878	-0.37	0.043
N-ANS	47.125	46.73	0.395	0.1
ANS-Gn	53.03	52.84	0.19	0.457
Ar-Go	45.142	44.88	0.262	0.003
Go-Pog	63.775	63.45	0.325	0.313
PNS-ANS	47.792	47.44	0.352	0.121
Pog-Pog'	10.208	9.78	0.428	0.123
Me-Me'	6.575	6	0.575	0.149

Na' - Me'	103.575	103.58	-0.005	0.434



Graph 1 Comparison of Parameters Between Two Groups

RESULTS

The means of all the angular and linear measurements were assessed and tabulated in the table no 1 and graph no 1 . A comparison of both methods showed statistically significant differences only for six out of eighteen measurements they are as follows:-

a. facial angle,
b. occlusal plane to SN angle,
c. interincisal angle,
d. cant of occlusal plane,
e. Go – Gn to SN angle
f. Ar – Go.

DISCUSSION

In the present study six (five angular and one linear) out of eighteen parameters showed statistically significant differences. These six parameters were facial angle, occlusal plane to SN angle, interincisal angle, cant of occlusal plane, Go – Gn to SN angle and Ar – Go plane.

Santoro et al[4] stated that gonion identification is difficult due to a poorly defined anatomical outline, a double image and localization away from the midsagittal plane.

Previous studies showed significant errors for landmark identification of Ar. This is in agreement with the results of the present study as Ar - Go showed significant differences. [5, 6]

Even though manual tracing is widely used, there are several disadvantages associated with the manual tracing. Studies of conventional cephalometric analysis have reported the major sources of error to stem from tracing, measuring, recording, and landmark identification.[5, 7, 8]

Bruntz et al[9] conducted a study to evaluate the process of scanning an analogue lateral cephalogram into digital format and assessing the accuracy of the digital cephalometric program. Statistically significant values were found for 6 of the 23 measurements. The 6 statistically significant measurements included facial plane, y-axis, occlusal plane, FMA, maxillary incisor to FH, and FH to Nasion-A point. Their results indicated that FH plane is unreliable in identification with digital media. Thus our study is in accordance with this study.

There are two ways to acquire a digital image. In direct imaging, the image is produced immediately on the monitor post-exposure. In Indirect acquisition, the image can be acquired by using a scanner with transparency adapter or a charged couple device camera. A photographic camera was not used to acquire a lateral

cephalogram as linear measurements may not be accurately measured.[10] Thus in this study, a scanner with transparency adapter was used.

Finally, comparison of the manual tracing technique with on-screen digitization also has a number of practical aspects. Software with an automatic edge definition feature is a promising tool for more accurate and reproducible cephalometrics.[11]

Further advantages such as the progress in digital acquisition of cephalometric images and data handling and storage stimulate further development of the on-screen tracing technique.

The direct digital cephalogram can totally eliminate the need for scanning the traditional radiographic film which not only requires an additional time-consuming step but also can introduce magnification errors.[12] Recently, the digital storage phosphor plate has been developed which has demonstrated improved subjective image quality than traditional cephalometric images.[13, 11] In comparison with the traditional screen – film system, a substantial reduction in radiation exposure could be achieved without detrimental effects on the determination of the cephalometric landmarks.[14]

If the films are scanned and transferred to digital format, as in this study, the quality of the original film is one of the most important criteria in the validity of the result.[2] Nemoceph Software recommends 150 dpi resolution for scanning. In current study, films were scanned at a resolution of 300 dpi. For scanning lateral cephalograms, it is suggested that 75 dpi is sufficient.[15] Chen et al[16] stated that digital cephalometrics could produce better results if digital images of 150 dpi, 8 bits were used; whereas in another study by Onkosuwito et al,[17] 300 dpi resolutions was reported to be sufficient for clinical purposes and comparable with analogue cephalograms. During landmark digitization, magnification was often used to more accurately identify certain structures. In several instances, the magnification caused significant pixilation and blurriness of the image, increasing the difficulty of accurate identification. Selecting a higher scanning dpi might assist in circumventing this problem. Thus we used resolution of 300 dpi.

The statistically significant difference between the values of Six parameters of Facad Software compared with conventional tracings requires further investigations as these differences could be clinically relevant.

CONCLUSION

In this study, a total of Eighteen cephalometric parameters (8 linear and 10 angular) were measured with manual method and Facad software.

A comparison of both methods showed statistically significant differences only for six out of eighteen measurements. Thus it can be concluded that digital tracing with Facad Software is sufficient for clinical purposes and comparable with manual cephalometric tracings.

REFERENCES

1) Hemlata Bhagwan Tanwani, Sheetal Sameer Potnis, Comparison of Conventional and Digital Cephalometric Analysis: A Pilot Study. Journal of Dental and Allied Sciences 2014;3:80-84
2) Sayinsu K, Isik F, Trayali G, Arun T. An evaluation of the errors in cephalometric measurements on scanned cephalometric images and conventional tracings. Eur J Orthod. 2007;29:105-108
3) Huja SS, Grubaugh EL, Rummel AM, Fields HW, Beck FM.Comparison of hand traced and Computerized superimpositions. Angle Orthod. 2009;79:428-435
4) Santoro M, Jarjoura K, Cangialosi TJ. Accuracy of digital and analogue cephalometric measurements assessed with the sandwich technique. Am J Orthod Dentofacial Orthop. 2006;129(3):345-51
5) Baumrind S , Frantz R C. The reliability of head film measurements 1. Landmark identification . Am J Orthod Dentofacial Orthop 1971; 60 :111 – 127.
6) TrpkovaB, Major P, Prasad N, Nebbe B. Cephalometric landmark identification and reproducibility: A meta analysis. Am J Orthod Dentofac Orthop 1997;112:165-170.
7) Baumrind S , Frantz R C. The reliability of head film measurements 2
Conventional angular and linear measures . Am J Orthod Dentofacial Orthop 1971; 60 : 505 – 517
8) Houston WJ, Maher RE, McElroy D, Sherriff M. Sources of errors in measurements from cephalometric radiographs. Eur J Orthod 1986;8:149-151
9) Bruntz LQ, Palomo JM, Baden S, Hans MG. A comparison of scanned lateral cephalograms with corresponding original radiographs. Am J Orthod Dentofacial Orthop. 2006;130(3):340-8
10) Collins J, Shah A, McCarthy C, Sandler J.Comparison of measurements from photographed lateral cephalograms and scanned cephalograms. Am J Orthod Dentofacial Orthop. 2007;132(6):830-3

11) Kazandjian S, Kiliaridis S, Mavropoulos A. Validity and reliability of a new edgebased computerized method for identification of cephalometric landmarks. Angle Orthod. 2006;76(4):619-24.
12) Santoro M, Jarjoura K, Cangialosi TJ. Accuracy of digital and analogue cephalometric measurements assessed with the sandwich technique. Am J Orthod Dentofacial Orthop. 2006;129(3):345-51
13) . Gijbels F, Serhal B, Willems G, Bosmans H, Persoons SM, Jacobs R. Diagnostic yield of conventional and digital cephalometric images: a human cadaver study Dentomaxillofac Radiol 2001; 30: 101-105.
14) Seki K, Okano T. Exposure reduction in cephalography with a photostimulable phosphor imaging system. Dentomaxillofac Radiol 1993;22:127-130.
15) Held CL, Ferguson DJ, Gallo MW. Cephalometric digitization: A determination of the minimum scanner settings necessary for precise landmark identification. Am J Orthod Dentofacial Orthop. 2001;119(5):472-81
16) Chen YJ, Chen SK, Chan HF, Chen KC. Comparison of landmark identification in traditional versus computer-aided digital cephalometry . Angle Orthod 2000;70:387 – 392.
17) Ongkosuwito EM, Katsaros C, Hof MAV, Bodegom JC, Kuijpers-Jagtman AM. The reproducibility of cephalometric measurements: a comparison of analogue and digital methods. Eur J Orthod 2002;24:655-665