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Time required for performing a manual cephalometric analysis compared to a digital cephalometric analysis on DentiCephX software

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Abstract

Introduction: Diagnostic cephalometric analysis can be performed manually as well as with the help of softwares. It is observed that a digital analysis is less time consuming as compared to a manual analysis. Therefore, the objective of this study was to measure the mean difference in time taken to perform a manual cephalometric analysis as opposed to an analysis performed with the help of digital cephalometric software.

Material and Methods: A total of 50 good quality cephalograms taken with the same machine were included in the study. They were randomly divided among four orthodontic residents (R1=13, R2=13, R3=12 and R4=12). All residents performed manual tracing and analysis followed by digitization and analysis on DentiCephX software. Time required for performing each task was recorded using a stopwatch. Paired sample t-test was used to compare the time required for performing a digital cephalometric analysis versus a manual cephalometric analysis. 10 radiographs were retraced after 2 weeks and intra class correlation coefficient was used to measure inter rater reliability.

Results: The mean time required for manual and digital cephalometric tracing and analysis was 07m: 06s ± 01m: 45s and 01m: 33s ± 00m: 32s respectively. The difference in time required for manual and digital tracing and analysis was statistically significant (p=0.001). p value ≤ 0.05 was considered as significant.

Conclusions: This study showed statistically significant difference in time required for performing a digital cephalometric analysis versus a manual cephalometric analysis.

Keywords: Cephalograms; cephalometric analysis; digitization; manual tracing

Introduction

For the past several decades, the orthodontists are using lateral cephalograms as one of the main diagnostic aids. Cephalometric analysis of these radiographs can be performed manually or digitally with the help of softwares.[1]

In manual method of analysis, radiographic images on acetate sheets are traced, landmarks are localized and then desired measurements are performed. While computerized cephalometric analysis involves landmarks localization on the lateral cephalogram in the software. The software then performs the analysis by automatic measurement. Software-aided cephalometric analysis can potentially reduce the time consumption in tracings and performing linear and angular measurements.[2]

Currently, number of softwares are available for this purpose with each having its own limitations and benefits. Some of the

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softwares can be operated with their mobile applications as well.[3]

There are numerous studies available in literature which have compared the manual tracing and analysis of lateral cephalograms with the different available softwares for cephalometric analysis in terms of accuracy and reliability, and most of the studies have established that the accuracy and reliability of manual method and computer-aided analysis is comparable.[4-10]. But, there are limited studies that have compared manual tracings with software based digitization and analysis in terms of time[11-14]. Also, there is no evidence regarding a comparison in the time difference between manual cephalometric tracing and analysis with the software based approach.

Hence, the objective of this study is to measure the difference in time taken to perform a manual cephalometric tracing and analysis as opposed to digitization and analysis performed with the help of DentiCephX software.

Material and Methods

Ethical approval was obtained from the Ethics Review Committee of Margalla Institute of Health Sciences, Rawalpindi. This was a cross sectional comparative study for which 50 cephalograms were selected based on inclusion and exclusion criteria and nonprobability convenience sampling was used.

The cephalograms included in the study were of good quality without any artifacts, obtained from the same machine and all cephalograms had full set of permanent dentition till at least first molars. The gender of patients was disregarded.

Exclusion criteria were cephalograms with gross asymmetry, resolution and contrast errors or patient positioning errors, cephalograms of patients with any craniofacial deformity and those in which superimposition of bilateral anatomical structures was not good.

The cephalograms were randomly divided among 4 orthodontic residents. All of the residents were enrolled in FCPS program for at least past 2 years. Each of these residents first performed digitization and analysis of 11 lateral cephalograms on this software as the part of their training for this study, before data collection was started.

All residents were assigned an alphabet for easy localization and marking of the lateral cephalograms traced by them. Researchers traced these lateral cephalograms by manual tracing method first and then performed the digitization and analysis of the same radiographs on the DentiCephX software.

The manual tracings were carried out on 0.003'' thick, acetate tracing paper in a dark room using the same illuminator (Fig 1). For the DentiCephX software JPG files were imported in the software and then magnification adjustment and manual digitization\ was performed, followed by analysis generation by the software (Fig 2).

A total of 14 measurements were recorded for the analysis. Time taken for the landmarks identification, tracing and analysis was recorded for both methods, with the help of a stop watch.

Each resident performed maximum 5 tracings in a day in order to avoid errors induced due to fatigue.

In order to measure, inter-observer reliability,

Figure 1: Manual Cephalometric Analysis

10 Cephalograms out of 50 were selected randomly and same researchers were asked to do the tracing and analysis both manually and on the software and time lapse was recorded. These re-tracings were done 2 weeks after the initial tracings.

Data was analyzed using Statistical Package for Social Sciences (SPSS Version 26.0). Quantitative variables were assessed as mean and standard deviation. Difference of time comparison between manual and digital tracing and analysis was calculated by paired sample t-test.

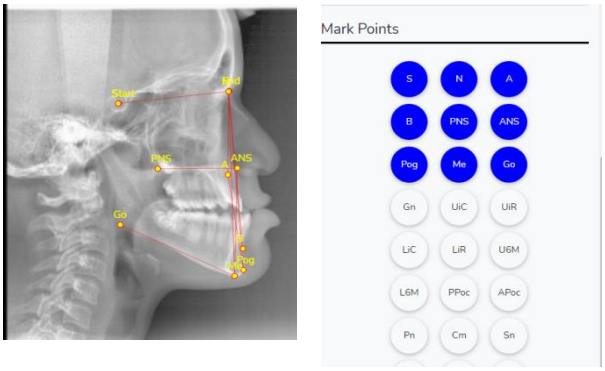

Figure 2: Analysis on DentiCephX Software

Results

Intra class Correlation Co-efficient was 0.69, which showed substantial agreement among 4 researchers.

Mean values of cephalometric tracing and analysis, manually and digitally are shown in

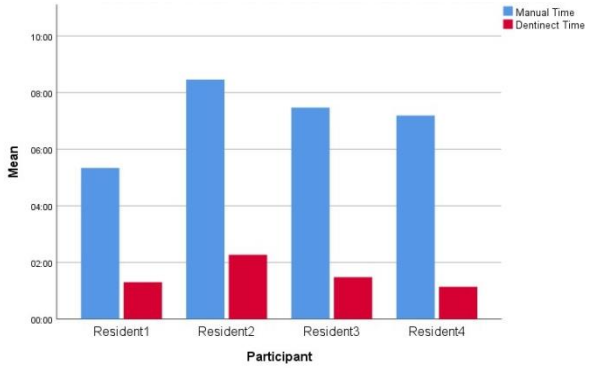

Figure 3: Clustered Bar Mean of Manual Time and DentiNect time by participants

Results of time comparison between manual and digital cephalometric tracing and analysis are shown in table I & II.

Table I: Time Comparison

	N	Mean	S.D
Manual Time (tracing, landmarks identification and analysis)	50	07m:06s	01m:45s
DentiNect Time (landmarks identification and automatic generation of tracing and analysis)	50	01m:33s	00m:32s

Table II: Paired Samples Correlations

	N	Correlation	Sig.
Manual time & DentiNect time	50	0.462	0.001

p value of time comparison between manual and digital cephalometric tracing and analysis was significant (0.001).

p value ≤ 0.05 was considered as significant.

In terms of efficiency, DentiCephX software significantly reduces the time needed for the process of measurement.

Discussion

Manual tracings of the cephalograms is the oldest and the most common method for accurate analysis but with the advent of computer-assisted cephalometric analyzing softwares, digital analysis of the radiographs have become the preferred method [11].

Manual method of a cephalometric analysis involves identifying landmarks followed by tracing and performing the linear and angular measurements. Whereas, a computer software enables automatic identification of the landmarks or point mark identification of anatomical landmarks by the user on the software window, followed by automatic analysis and generation of diagnostic summary by the software itself.[13]

Computer-assisted cephalometric analyzing tools have several advantages over existing conventional methods for instance saving electronic records, printable summaries, remote sharing due to which practitioners are rapidly adapting these softwares. One of the reasons for adaptation to cephalometric analyzing tools is its ability to enhance time efficiency.[14]

Adapting to digitization is an absolute need of the hour not only to save time but to reduce practice burden and channel orthodontic workflow.

Chen *et al* evaluated the time required for the cephalometric analysis on the software and established that the time for doing cephalometric measurements can be minimized by this method.[13]

Similarly, Iseri *et al* evaluated the time performance of software-assisted and manual cephalometric tracing methods and established that the researchers took less time in software-assisted tracings .[17]

In the present study, the time taken by the examiners was almost thrice that for the conventional method of manual cephalometric analysis. It is highly recommended for Orthodontic residency programs to adapt to growing digital needs for enabling a connected care solution for residents and patients alike.[18]

However, the time needed for preparation of the films for manual tracing and uploading of the lateral cephalograms for the digital analysis was considered, which serves as the limitation of this study.

Conclusions

Time required for digital cephalometric tracing and analysis was less than the manual method.

Conflict of interest

The authors declares that there is no conflict of interest, financial support of sponsorship.

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