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Review Article

Comparing accuracy of semiautomated mobile tracing app oneceph with manual cephalometric tracing

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Abstract

Background: Tracing of Lateral cephalograms using Semiautomated mobile tracing app making pre-orthodontic treatment investigations much easier and faster. Various cephalometric analysis can be performed using these smart apps.

Aim & Objectives: This study was undertaken to assess the reliability of linear measurements obtained from OneCeph digital cephalometric tracing with manual tracings for cephalometric investigation.

Materials and Methods: A total of thirty lateral cephalometric radiographs were taken randomly from patients above 12 years reported for orthodontic problems. Linear measurements from Schwarz analysis and jarabak ratio were recorded, first manually traced, followed by android‑based OneCeph digital cephalometric tracer. Independent T-sample test was done between the mean values of manual and OneCeph tracing.

Results: No statistically significant difference between the values obtained for analysis by android‑based tracing and manual cephalometric tracing.

Conclusion: This study showed that digital tracing with the OneCeph software demonstrates close accuracy in comparison with manual tracing and could be used instead of the traditional methods for various orthodontic analysis.

Keywords: Oneceph app, Semiautomated tracing, Lateral cephalogram tracing

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1. Introduction

The rise of digital dentistry has closely paralleled advancements in orthodontics. It includes digital workflow, computer-aided manufacturing, CAD software, 3D printing, intraoral scanners etc. which made new procedures and materials available for dental use. Similarly in orthodontics, not only computer based software but smartphone based applications also managing patient records, their education, diagnosis, and treatment planning. Given the high workload in clinics, manual tracing of lateral cephalogram for every patient is nearly impossible for clinicians. In a landscape where resources are often limited, the ability to perform cephalometric tracings on mobile devices has been a significant breakthrough.

Recent advancements in diagnosis and treatment planning through computer-assisted programs have significantly enhanced the clinician's ability to assess problems from multiple dimensions, leading to more accurate diagnoses and treatment plans.[3]

Cephalometry, first introduced by Broadbent in 1931, has long been an essential tool in orthodontic diagnosis.[1] Over time, it has evolved from manual tracing to computer-assisted digital tracing.

The advantages of using computer-assisted digital cephalogram tracing over traditional manual tracing are improved precision, reduced errors, faster processing, less time required, lower inventory needs, minimized physical storage, and fewer reproducibility errors.[11] In recent years, smartphone applications have taken on the role of computer software in performing cephalometric analysis.[13] These apps are portable, often free of charge, and can run on Android and other operating systems.[2] However, as technology advances, questions surrounding their accuracy, reliability, and

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reproducibility arise. Current smartphone apps for cephalometric analysis can be either automatic (AI-powered) or semi-automatic (requiring manual landmark identification). One ceph app is semiautomated mobile tracing app.

Mobile cephalometric software app which is readily accessible through our smartphones is the need of the hour. One such app is the OneCeph (version beta 1.1, NXS, Hyderabad, India) which is free to use app available on the Android play store. In this study, we compared the accuracy and reliability of cephalometric measurements made using the OneCeph app against the conventional manual tracing using linear measurments of Schwarz analysis and jarabak's ratio.

2. Materials and Methods

The sample size of 30 patients was determined using the nMaster 2.0 sample size software, employing the mean with equal allocation method based on data obtained from a previous study. The final sample size, considering an effect size of 0.75 and power set at 80%, was calculated to be 30. The included cephalograms were analyzed using two different methods of cephalometric tracing, forming two distinct groups: Group A (Manual Tracing), Group B (OneCeph).

Pre-treatment lateral cephalograms were obtained from the Department of Oral Medicine and Radiology.

2.1. Selection criteria

Lateral cephalogram of individuals who were candidates for orthodontic treatment were included in the study. The inclusion criteria were as follows:

1. Completely erupted permanent teeth till second molar.
2. No congenital deformity involving dento-alveolar structures in maxilla and mandible
3. No history of previous orthodontic treatment

All lateral cephalograms were taken with the Frankfort horizontal plane parallel to the floor and the midsagittal plane perpendicular to the X-ray beam, with the patient in centric occlusion and relaxed lips. All landmarks were identified by the same orthodontist. In cases where bilateral anatomical structures were superimposed or double images occurred, the midpoint was selected. Five measurements were recorded, including four linear measurements from Schwarz analysis which are cranial base length, mandibular, maxillary base length, ramal length and one Jarabak's ratio using a scale and protractor. For digital tracing, the images were directly exported in JPEG format, calibrated, and the same calibration was applied across all measurements to minimize errors in linear measurements.

2.1. Manual tracing

Manual tracings were performed on an illuminated view box in a dark room. A sheet of matte acetate tracing paper was taped over the X-ray printout, and the outlines were hand-traced using a 0.5 mm lead pencil. Linear measurements from Schwarz analysis and the Jarabaks ratio were measured using a scale and protractor.

2.2. Digital tracing

For digital cephalogram measurements, digital images of the selected cephalograms in JPG format were imported into the OneCeph application.

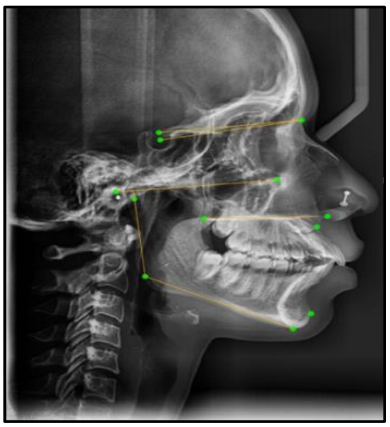

Figure 1: Lateral cephalogram with marked landmarks

Figure 2: Showing values from the Schwarz analysis appearing on mobile screen

Available on Google Play Store) on an Android smartphone (Samsung A-50, Samsung Telecommunications, Suwon, South Korea). After calibrating the images based on the calibration scale and marking, skeletal and dental landmarks for linear measurent in Schwarz analysis and the Jarabak ratio as shown in (**Figure 1**).

All the respective values appeared on mobile screen as shown in (**Figure 2**).

3. Results

In this study 4 linear measurements were chosen from schwarz analysis along with jarabak's ratio. The comparison of mean values of all the measurements from one-ceph app was done with manual tracing using Independent t test.

Table 1 shows the comparison of mean linear measurments in schwarz analysis and jarabaks ratio values obtained from manual, and digital OneCeph analysis. It was found that there was no statistical significant difference (P = 0.560) in the mean values obtained from the manual and digital OneCeph analysis.

Table 1: Comparison of mean, standard deviation, and standard error of manual tracing and OneCeph tracing for a confidence interval of 95% for the parameters of Schwarz analysis and jarabaks ratio.

	Manual method			Oneceph			t test value	P value
	Mean	SD	SE	Mean	SD	SE		
Cranial base length	62.4	4.76	1.06	65.1	7.55	1.68	t = -1.392	p=0.172(NS)
Mandibular base L	67.57	6.26	1.39	70.94	7.03	1.57	t = -1.598	p=0.118(NS)
Maxillary base L	47.51	3.92	0.87	44.45	5.99	1.34	t = 1.909	p=0.064(NS)
Ramus Length	49.35	5.84	1.3	48.41	7.68	1.71	t = 0.433	p=0.667(NS)
Jarabaks ratio	68.79	6.355	1.42	67.14	6.01	1.34	t =0.845	p=0.403(NS)

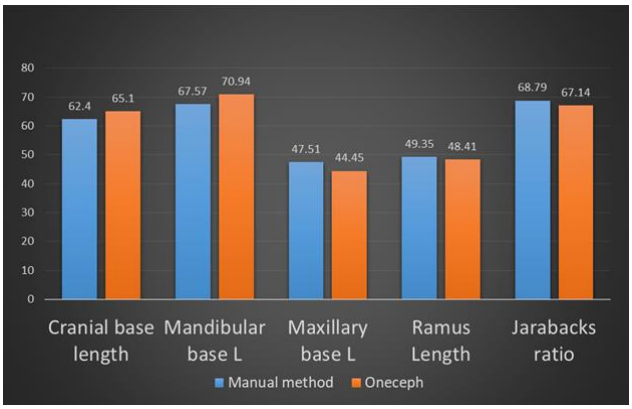

Figure 3: Bar diagram showing comparison of mean values of cephalometric readings Obtained in manual tracing (blue) and in digital tracing (orange).

4. Discussion

Lateral cephalogram play a crucial role in dental diagnosis and treatment planning, particularly in orthodontics and pediatric dentistry.[7] In this technological era, manual cephalometric tracing is gradually being replaced by digital cephalometric programs. Recently, the use of smartphone-based apps for cephalometric tracing has seen a significant increase.[9]

Tracing cephalogram, identifying landmarks, and performing superimpositions are time-consuming tasks plus it requires extra inventory needs like x-ray view box, measuring scales, drawing tools etc. The process is time-consuming, and measuring cephalometric angles using scales, protractors can be cumbersome and nearly impossible to perform during consultation based practice.[8] A semi-automated tracing app on a mobile phone could streamline this process, enhancing the credibility of work and aiding in treatment planning decisions.[10]

Recent advancements in technology, such as the OneCeph app, provide significant benefits, including lower radiation exposure, improved data storage, and ease of image tracing. Regardless of whether digital tracing is performed using specialized software or a smartphone app, it is essential that the method remains reliable, precise, and reproducible.[12]

In this study, after comparing measurements of cranial base, maxillary, mandibular, and ramal lengths with Jarabak's ratio, the greatest deviation was observed in cranial base length, while the least deviation was noted in Jarabak's ratio.[14] This discrepancy may be attributed to factors such as improper calibration, magnification error, or inconsistencies in the app's linear measurement capabilities

This Android-based app includes programs for widely used analyses such as Downs, Holdways, Jarabak, McNamara, Ricketts, Steiners, Schwarz, Tweed, Wits Appraisal, Beta angle, and Yen angle.[13] The potential of smartphones to simplify complex, time-consuming tasks like cephalometric analysis while offering structured reference materials and e-learning capabilities is a key feature of this app. While digital cephalometric tracers require calibration, improper calibration can affect linear measurements, although angular measurements tend to be more robust.[6] A study by Chen et al. showed a reduction in time required for cephalometric measurements when using a computer-assisted digital system compared to traditional methods.[4] A recent study by Deema Abdul Khader demonstrated that the One Ceph app is as reliable as the Dolphin cephalometric method.[13] Minimal variations noted in a study by Shettigar et al. could be attributed to differences in operator reproducibility and calibration of the cephalometric image in the app.[5] In a study by Roden-Johnson et al. no significant difference was found between manual and Quick Ceph 2000 for landmark identification, which aligns with our findings.[15]

Tsorovas and Karsten conducted a study comparing hand tracing and five different digital cephalometric programs. Their results showed no statistical difference in measurements between the two methods, but hand tracing required significantly more time, which was consistent with the findings of our study.[11] Study done by Khader DA on Reliability of One Ceph software shows results in accordance with our study.[13]

Mitra, Rajat conducted a study on Determination of the comparative accuracy of manual, semi-digital, and fully digital cephalometric tracing methods in orthodontics and found no significant difference between manual, semi-digital, and fully digital cephalometric tracing with good agreement among all variables except two linear variables, which were traced more accurately in semi-digital method. The preference of using on particular technique can be based on the availability, expertise, and ease of availability.[17]

In study done by Akash mohan on Evaluating accuracy and reliability of OneCeph digital cephalometric analysis in comparison with manual cephalometric analysis, they concluded- The reliability and accuracy of OneCeph software application was found to be at par with manual cephalometric tracing. This result is in accordance with our study.[16]

According to Dr. Anfiya Nazeer's study on reliability of the OneCeph software application Itwas at par Dolphin digital method and with manual tracing. OneCeph is a simple, reliable, accurate alternative to manual tracing which can be easily accessed on a smartphone without an internet connection thereby saving clinical time and armamentarium.[18]

A study by Julia Naoumova on comparison of manually traced images and corresponding scanned radiographs digitally traced- stated that there is greater variability in digital cephalometric measurements. Differences in Gn, Li, Si, and Ii-Li measurements between the two methods were statistically ($P < 0.05$), but not clinically significant. The findings indicate that the results of the two investigated tracing methods are similar and that digital tracing is reliable and can be used routinely.[19,20,21]

5. Conclusion

This study showed that digital tracing with the OneCeph software demonstrates close accuracy in comparison with manual tracing and could be used instead of the traditional methods for various orthodontic analysis.

Human ethics and consent to participate declarations: Not applicable **(**As not any patient photographs were used**)**

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None.

7. Conflict of Interest

None.

Reference

1. Broadbent BH. A new x-ray technique and its application to orthodontia. *Angle Orthod*.1931;1(2):45-66.
2. Shettigar P, Shetty S, Naik RD, Basavaraddi SM, Patil AK. A comparative evaluation of reliability of an android-based app and computerized cephalometric tracing program for orthodontic cephalometric analysis. *Biomed Pharmacol J.* 2019;12(1):36-8.
3. Roden-Johnson D, English J, Gallerano R. Comparison of hand-traced and computerized cephalograms: Landmark identification, measurement, and superimposition accuracy. *Am J Orthod Dentofacial Orthop.* 2008;133(4):556-64.
4. Chen SK, Chen YJ, Yao CC, Chang HF. Enhanced speed and precision of measurement in a computer-assisted digital cephalometric analysis system. *Angle Orthod*. 2004;74(4):501-7.
5. Aksakallı S, Yılancı H, Görükmez E, Ramoğlu Sİ. Reliability assessment of orthodontic apps for cephalometrics. Turk J Orthod. 2016;29(4):98-102.
6. Tikku T, Khanna R, Maurya RP, Srivastava K, Bhushan R. Comparative evaluation of cephalometric measurements of monitor-displayed images by Nemoceph software and its hard copy by manual tracing. *J Oral Biol Craniofac Res*. 2014 Jan-Apr;4(1):35-41.
7. Uysal T, Baysal A, Yagci A. Evaluation of speed, repeatability, and reproducibility of digital radiography with manual versus computer-assisted cephalometric analyses. *Eur J Orthod.* 2009;31(5):523-8.
8. Naoumova J, Lindman R. A comparison of manual traced images and corresponding scanned radiographs digitally traced. *Eur J Orthod*. 2009;31(3):247-53.
9. Celik E, Polat-Ozsoy O, Toygar Memikoglu TU. Comparison of cephalometric measurements with digital versus conventional cephalometric analysis. *Eur J Orthod*. 2009 Jun;31(3):241-6.
10. Prabhakar R, Rajakumar P, Karthikeyan MK, Saravanan R, Vikram NR, Reddy A. A hard tissue cephalometric comparative study between hand tracing and computerized tracing. *J Pharm Bioallied Sci*. 2014;6(Suppl 1):S101-6.
11. Tsorovas G, Karsten AL. A comparison of hand-tracing and cephalometric analysis computer programs with and without advanced features--accuracy and time demands. *Eur J Orthod* 2010;32(6):721-8.
12. Chen YJ, Chen SK, Chang HF, Chen KC. Comparison of landmark identification in traditional versus computer-aided digital cephalometry. Angle Orthod. 2000;70(5):387-92.
13. Khader DA, Peedikayil FC, Chandru TP, Kottayi S, Namboothiri D. Reliability of One Ceph software in cephalometric tracing: A comparative study. *SRM J Res Dent Sci.* 2020;11(1):35-9
14. Chen YJ, Chen SK, Yao JC, Chang HF. The effects of differences in landmark identification on the cephalometric measurements in traditional versus digitized cephalometry. *Angle Orthod*. 2004;74(2):155-61.
15. Rajat M, Chauhan A, Sardana S, Londhe SM, Jayan B, Maurya RK. Determination of the comparative accuracy of manual, semi-digital, and fully digital cephalometric tracing methods in orthodontics. *J Dent Defence Sec*. 2020;14(2):52-8.
16. Mohan A, Sivakumar A, Nalabothu P. Evaluation of accuracy and reliability of OneCeph digital cephalometric analysis in comparison with manual cephalometric analysis—a cross-sectional study. *BDJ Open*. 2021;7:22.
17. Mamillapalli PK, Sesham VM, Neela PK, Mandaloju SP, Keesara S. A smartphone app for cephalometric analysis. *J Clin Orthod*. 2016 Nov;50(11):694-633.
18. Nazeer A, Paul S, Chacko P, Peter V, Prachoth CA. Muhammed A, et al. Comparative evaluation of the reliability of cephalometric analysis using oneceph and dolphin imaging software against

manual tracing - a cephalometric study. *J Dent Defence Sec*. 2020;14(2):52–8.

19. Ongkosuwito EM, Katsaros C, van 't Hof MA, Bodegom JC, Kuijpers-Jagtman AM. The reproducibility of cephalometric measurements: A comparison of analogue and digital methods. *Eur J Orthod.* 2002;24(6):655-65.
20. Naoumova J, Lindman R. A comparison of manual traced images and corresponding scanned radiographs digitally traced. *Eur J Orthod.* 2009;31(3):247–53.
21. Celik E, Polat-Ozsoy O, Memikoglu TU. Comparison of cephalometric measurements with digital versus conventional cephalometric analysis *Eur J Orthod*. 2009;31(3):241–6

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