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Evaluation of android based application and computerized Cephalometric tracing program in relation to manual tracing -A retrospective study

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Abstract

Introduction: Lateral Cephalogram can now be traced using softwares like Dolphin and android-based applications like OneCeph making dentist's work easier and time saving. Various orthodontic analysis can also be carried out using these applications and software.

Aim: To study the accuracy of the cephalometric values of OneCeph (android based application) and Dolphin Imaging software (computerized cephalometric tracing program) considering manual tracing as existing standard for cephalometric analysis.

Materials and Methods: A total of 29 lateral cephalograms were taken from patients who reported to the department with malocclusion. Downs, Steiners, Tweed and McNamara analysis was carried out for each cephalogram and various cephalometric landmarks were recorded. First it was manually traced and analyzed which was followed by android-based application OneCeph and Dolphin software. Values obtained were compared with that of the existing standard – manual tracing by repeated measure ANOVA. Pair-wise measurement comparison was performed to identify which group had more correlation.

Results: Out of 28 parameters studied ,19 parameters of Dolphin were found closer to manual, which are Angle of Convexity, Mandibular Plane Angle, Y-Axis, SNB, SN-GoGn, Occlusal Plane, U1-NA(linear), L1-NB(linear) Cant of Occlusion, Interincisal angle, U1-A Pog, Upper lip to S line, FMA, FMIA, IMPA, Effective Mandibular Length, Effective Maxillary Length, Maxillary – Mandibular Length Difference, Lower Anterior Facial Height. 9 parameters of OneCeph were found closer to manual which are Facial Angle, Incisor-

OP Angle, SNA, ANB, U1-NA (angle), Lower lip to S line, A-B Plane angle, L1-NB(Angle).

OneCeph can be used as an alternative for manual tracing for the following parameters, Facial Angle Incisor-OP Angle, SNA, ANB, U1-NA (angle), Lower lip to S line.

Dolphin can be used as an alternative for manual tracing for the following parameters, the Angle of Convexity, Cant of Occlusion, Interincisal angle, U1-A Pog, Upper lip to S line, FMA, FMIA, IMPA Effective Mandibular Length, Effective Maxillary Length, Maxillary – Mandibular Length Difference, Lower Anterior Facial Height.

Conclusion: OneCeph can be used as an alternative for 6 parameters. Dolphin can be used as an alternative for manual tracing for the 12 parameters. Dolphin is a better alternative than OneCeph as more parameters are closer to manual.

Keywords: Digital Cephalometrics, OneCeph, Dolphin.

Introduction

Lateral Cephalogram can now be traced using softwares like Dolphin and android-based applications like OneCeph making dentist's work easier and time saving. Recently there has been a rise in the usage of the latest technologies in all aspects of our lives. This is particularly true when it comes to Smartphone's, which are not only used to makes calls which was the primary use but now has been graduated for uses from taking pictures to diagnosis and analyzing various measurements in medical and dental field. Its role in Orthodontics is no less too.

Cephalometric tracing and measurements in orthodontics may now be performed on smart phones using apps like OneCeph. Because of their speed, cloud storage, and portability, these smart phone applications are perfect aids when rapid reference is required but access to a desktop computer is not possible.

Given the increased use of computer-assisted cephalometric tracing programs in daily orthodontic practices, it's important to evaluate the accuracy of commercially available cephalometric tracing software so that clinicians may choose the best software and analytic methodologies.

According to Pavan Kumar Mamillapalli et al[1]., traditional cephalometric analysis is time consuming and technically demanding, which lead to his development of an application called "OneCeph," with his team. OneCeph provides a convenient interface with the most commonly used analyses which simplify any complex and time-impeding task like composite cephalometric analysis to be completed in no time. It can be downloaded for free from Google Play Store and is as the most user-friendly application, with a very methodological approach and numerous options for sharing the data.

The aim of this study is to compare the cephalometric values between OneCeph (android-based application), Dolphin Imaging Software (computerized cephalometric tracing program) to Manual tracing for cephalometric analysis.

Methodology

Materials

- Cephalometric radiographs are randomly collected from patients who had reported to the Department of Orthodontics and Dentofacial Orthopedics.
- The 29 cephalograms were recorded using Planmeca promax cephalometer and were imported into Dolphin Imaging software V.11.5. (Dolphin Imaging and management solutions, Chatsworth, CA 91311, United States).
- Digital radiogram were imported to the OneCeph

application.

- Manual tracing was done on matte acetate paper using a sharp 3H drawing pencil.

Methodology

The study was conducted in the department of Orthodontics and Dentofacial Orthopaedics, Yenepoya Dental College, Yenepoya (Deemed to be University), Deralakatte , Mangalore. Ethical clearance was obtained from the Yenepoya University Ethics Committee 2 (YUEC-2). Twenty-Nine lateral cephalograms were randomly selected for this study based on the inclusion and exclusion criteria. Each cephalogram was evaluated for accuracy under 3 groups. Group 1 is manual tracing as control group, Group 2 is OneCeph , Group 3 is Dolphin Imaging software. The analysis for 3 groups was done by the principal investigator. **A**s intra-examiner error is lesser than the inter-examiner error, only one examiner carried out identification, tracing and analysis for all the 3 groups.

Group 1 – Manual analysis as control group

Procedure for manual tracing

Hard copy of cephalograms of the subjects were viewed using the x-ray viewer.

Matte acetate paper was placed over it and manual tracing was done with a sharp 3H drawing pencil.

Hard and soft tissues were marked (angular and linear measurements).

Fig 1: Manual Tracing with Cephalogram

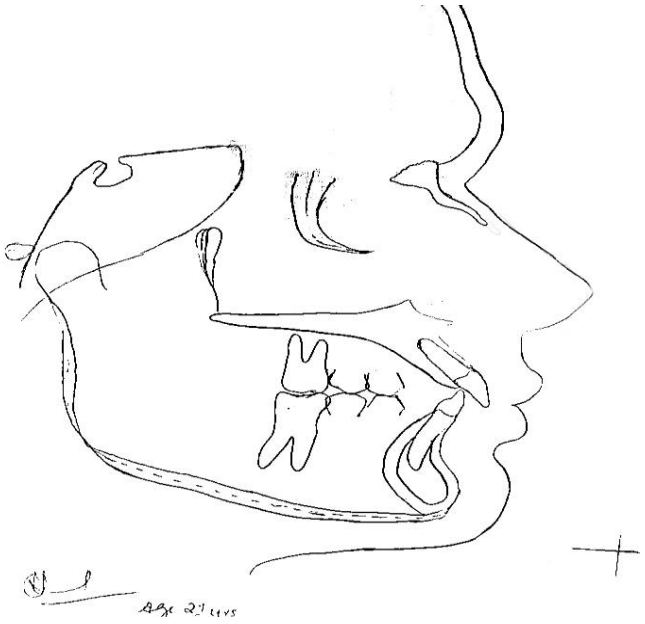

Fig 2: Manual Tracing

Group 2- OneCeph

Soft copy of the same cephalogram was imported to OneCeph application. At the start of tracing, digital cephalogram was calibrated to a minimum distance of 10mm. Based on the analysis chosen the required points were marked (both hard and soft tissue landmarks). The area of interest was zoomed , brightness and contrast were adjusted with the help of controls to locate the landmarks precisely.[23]

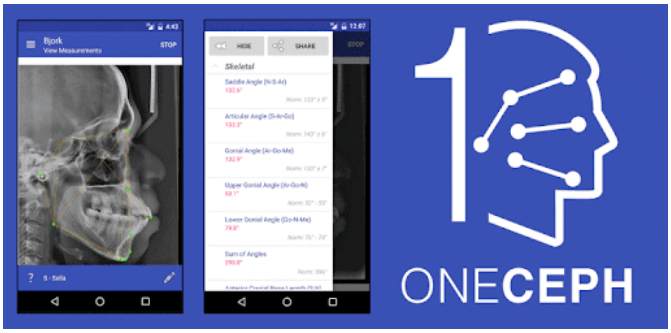

Figure 2: Digital tracing with OneCeph app.

Fig 3: Digital tracing with OneCeph App

Group 3-Dolphin

The digital images were imported to the Dolphin Imaging software and the digital tracing was done using Dolphin imaging V.11.5 (Dolphin Imaging and management solutions, Chatsworth, CA 91311, United States).

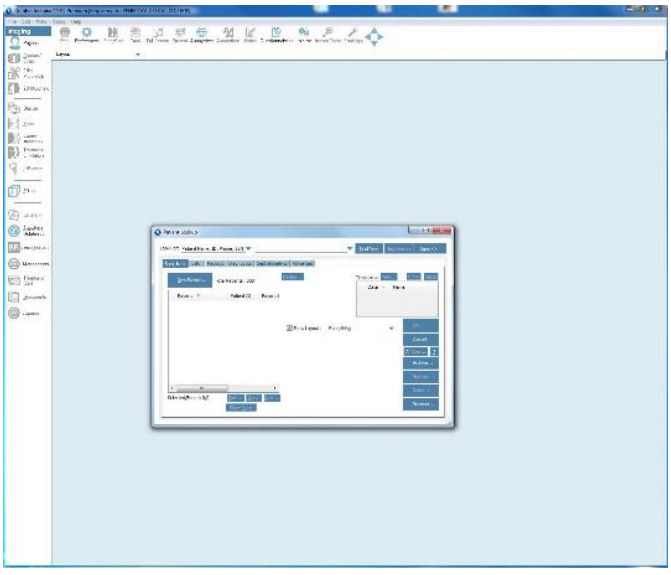

Fig 4: Dolphin software

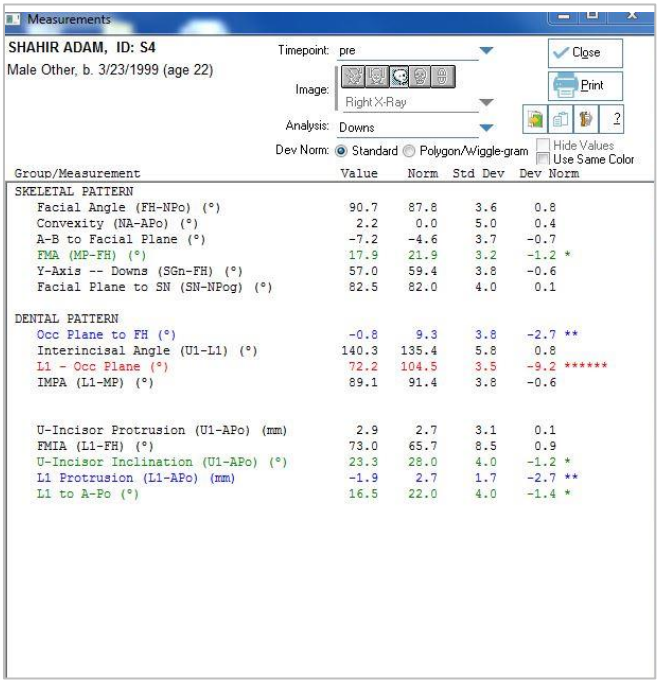

Fig 5: Downs analysis through Dolphin software

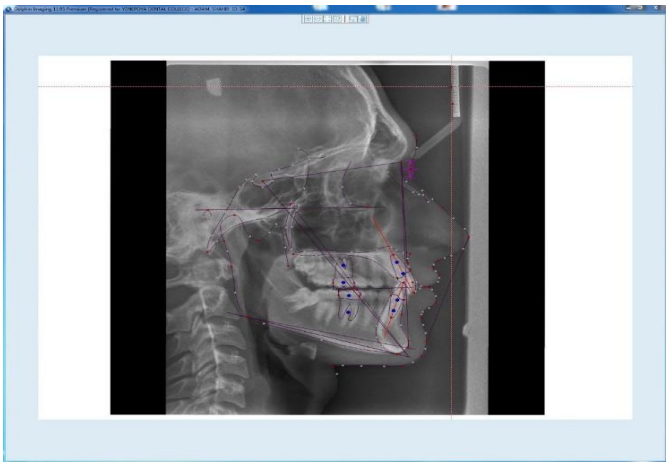

Fig 6: Landmarks through Dolphin software

Results

The parameters used were from Downs , Steiners , Tweeds, McNamara analysis. They were compared using repeated measure ANOVA. Pair-wise measurement comparison was performed to identify which group had more correlation. Analysis was performed using SPSS version 22. Level of significance in the present study was<0.05%. The collected data were analysed using descriptive statistic method. Descriptive methods such as mean and standard deviation from continuous data.

Table 1: Comparison of the mean of Dolphin and OneCeph to Manual

Sn.	Parameters	Manual - Standard	OneCeph	Dolphin
1.	Facial Angle	87.55	87.59 ✓	87.65
2.	Angle Of Convexity	6.12	6.78	6.05 ✓
3.	A-B Plane	-6.39	-7.35 ✓	-7.45
4.	Mandibular Plane Angle	22.98	24.51	24.44 ✓
5.	Y Axis	58.12	59.53	58.92 ✓
6.	Cant of Occlusion	4.81	5.74	5.20 ✓
7.	Interincisal Angle	125.02	125.65	125.22 ✓
8.	Incsior -OP Angle	15.50	15.01 ✓	14.82
9.	Incisor MP Angle	4.63	4.98 ✓	5.26
10.	U1 – A-Pog	4.51	7.47	5.96 ✓
11.	SNA	83.76	83.88 ✓	83.36
12.	SNB	79.90	80.36	79.95 ✓
13.	ANB	3.83	3.78 ✓	3.43
14.	SN-GoGn	31.38	32.05	31.89 ✓
15.	Occlusal Plane	10.28	11.04	10.71
16.	U1-NA (Angle)	28.68	28.56 ✓	27.77
17.	U1-NA (linear)	6.31	5.52	6.26 ✓
18.	L1-NB (Angle)	27.01	27.75 ✓	27.78

19.	L1-NB (Linear)	6.50	5.81	6.13 ✓
20.	Upper Lip to S Line	0.07	0.37	0.03 ✓
21.	Lower Lip To S Line	1.53	1.56 ✓	2.00
22.	FMA	24.41	24.81	24.47 ✓
23.	FMIA	57.62	55.31	55.62 ✓
24.	IMPA	98.31	99.88	99.85 ✓
25.	Effective Mandibular Length	114.90	114.40	114.89 ✓
26.	Effective Maxillary Length	89.07	88.78	88.94 ✓
27.	Maxillary – Mandibular Length difference	25.69	25.35	25.94 ✓
28.	LAFH	65.07	64.51	65.21 ✓

Out of 28 parameters used in the study, 19 parameters of Dolphin were found closer to manual which are Angle of Convexity, Mandibular Plane Angle, Y-Axis, SNB, SN-GoGn, Occlusal Plane, U1-NA(linear), L1-NB(linear) Cant of Occlusion, Interincisal angle, U1-A Pog, Upper lip to S line, FMA, FMIA, IMPA, Effective Mandibular Length, Effective Maxillary Length, Maxillary – Mandibular Length Difference, Lower Anterior Facial Height

Out of 28 parameters used in the study, 9 parameters of OneCeph were found closer to manual which are Facial Angle, Incisor-OP Angle, SNA, ANB, U1-NA (angle), Lower lip to S line, A-B Plane angle, L1-NB(Angle).

Table 2: The Mean of non-significant values which are closer to Manual

Sn.	Parameters	Manual (Standard)	OneCeph	Dolphin
1.	Facial Angle	87.55	87.59 ✓	87.65
2.	Angle Of Convexity	6.12	6.78	6.05 ✓
3.	Cant Of Occulsion	4.81	5.74	5.20 ✓
4.	Interincisal Angle	125.02	125.65	125.22 ✓
5.	Incsior -OP Angle	15.50	15.01 ✓	14.82
6.	U1 – A-Pog	4.51	7.47	5.96 ✓
7.	SNA	83.76	83.88 ✓	83.36
8.	ANB	3.83	3.78 ✓	3.43
9.	U1-NA (Angle)	28.68	28.56 ✓	27.77
10.	Upper Lip to S Line	0.07	0.37	0.03 ✓
11.	Lower Lip To S Line	1.53	1.56 ✓	2.00
12.	FMA	24.41	24.81	24.47 ✓
13.	FMIA	57.62	55.31	55.62 ✓
14.	IMPA	98.31	98.88	99.85 ✓
15.	Effective Mandibular Length	114.90	114.40	114.89 ✓
16.	Effective Maxillary Length	89.07	88.78	88.94 ✓
17.	Maxillary – Mandibular Length difference	25.69	25.35	25.94 ✓
18.	LAFH	65.07	64.51	65.21 ✓

Out of 28 parameters used in the study 18 parameters were Non-Significant.

Out of 18 parameters which were non-significant 12 parameters which are Angle of Convexity, Cant of Occlusion, Interincisal angle, U1-A Pog, Upper lip to S line, FMA, FMIA, IMPA Effective Mandibular Length, Effective Maxillary Length, Maxillary – Mandibular Length Difference, Lower Anterior Facial Height are closer to manual.

Out of 18 parameters used in the study, 6 parameters of OneCeph were found closer to manual which are Facial Angle, Incisor-OP Angle, SNA, ANB, U1-NA (angle), Lower lip to S line.

Discussion

The present study was carried out to compare and analyse the accuracy between OneCeph (android based application), Dolphin Imaging software (computerized cephalometric tracing program) and Manual tracing as the pre-existing standard

The study used 29 lateral cephalograms from the department of Orthodontics and Dentofacial Orthopedics, Yenepoya Dental College. The lateral cephalograms were selected on the basis of inclusion and exclusion criteria. The data was imported to Dolphin Imaging software and a softcopy was transferred to OneCeph. The hard copy was used for manual tracing. All cephalograms were traced on 0.003-inch-thick Matte cellulose paper on a view box and tracing was done using a sharp 3H drawing pencil.

On cephalograms, the contours of the following structures were identified and traced for the study: Nasion, Orbitale, Sella, Porion, Point A, Point B, Mandibular plane, FH plane, SN plane, Incisal and root tip of upper and lower incisors, long axis of upper and lower incisors. Various landmarks and locations were identified and marked for the required Parameters.

The intra-examiner error is lesser than the inter-examiner error, thus, to reduce the possibility of errors, this study was standardized by having only one examiner for both Dolphin cephalometric method and OneCeph app cephalometric method.[2]

In this study A-B Plane angle, SN-GoGn, U1-NA (linear), L1-NB (Angle), L1-NB (linear), SNB showed a difference between the OneCeph, Dolphin with Manual as these parameters share a common point N which is difficult to identify and locate. According to literature Sekiguchi and Savara[6] showed that nasion (N) might be challenging to locate when the nasofrontal suture is not clearly seen and this might have contributed for the difference.

The point gonion,orbitale, porion, menton and lower incisor apex is found to be the most inconsistent and unreliable points according to Chen YJ[3,4] Shettigar P[5] which might have contributed to the difference in Mandibular Plane Angle , Y – Axis , Incisor – MP angle, SN-GoGn, L1-NB (Angle), L1-NB(linear).

According to Shettigar P[5] the position of gnathion which is used to form a line with gonion to measure the mandibular plane angle shows variation in its' position in the vertical and horizontal axes. This may be due to the difficulty in identifying the landmark on the curved anatomical region[4] which have contributed to the difference in the parameter SN-GoGn, Mandibular plane angle. This also led Y-axis to show a difference as they share the common point Gnathion.

According to Jacobson et al[6], Barbhuja[7] studies have shown that the reason for incorrect identification of Point A is soft tissues near anterior nasal spine which cast shadows in X-ray, making it more difficult to identify the point.[6] can also be the reason for the A-B plane to show the difference.

Conclusion

After reviewing and evaluating different parameters and statistical methods as well as understanding the literature which upholds the digital software as well as android App-Based Software to manual Cephalograms, these are the conclusions that were found after the study:

Out of 28 parameters used in the study,19 parameters of Dolphin were found closer to manual which are Angle of Convexity, Mandibular Plane Angle, Y-Axis, SNB, SN-GoGn, Occlusal Plane, U1-NA(linear), L1-NB(linear) Cant of Occlusion, Interincisal angle, U1-A Pog, Upper lip to S line, FMA, FMIA, IMPA, Effective Mandibular Length, Effective Maxillary Length, Maxillary – Mandibular Length Difference, Lower Anterior Facial Height. 9 parameters of OneCeph were found closer to manual which are Facial Angle, Incisor-OP Angle, SNA, ANB, U1-NA (angle), Lower lip to S line, A-B Plane angle, L1-NB(Angle). Hence we can conclude that Dolphin is more definitive on comparision with manual than OneCeph on comparision with manual.

OneCeph can be used as an alternative for manual tracing for the following parameters , Facial Angle Incisor-OP Angle, SNA, ANB, U1-NA (angle), Lower lip to S line.

Dolphin can be used as an alternative for manual tracing for the following parameters, the Angle of Convexity, Cant of Occlusion, Interincisal angle, U1-A Pog, Upper lip to S line, FMA, FMIA, IMPA Effective Mandibular Length, Effective Maxillary Length, Maxillary – Mandibular Length Difference, Lower Anterior Facial Height.

References

1. Mamillapalli PK, Sesham VM, Neela PK, Mandaloju SP, Keesara S. A smartphone app for cephalometric analysis. J Clin Orthod. 2016 Nov 1;50:694-33.
2. Erkan M, Gurel HG, Nur M, Demirel B. Reliability of four different computerized cephalometric analysis programs. Eur J Orthod.; 34(3):318-21 (2012).
3. Jacobson RL, Jacobson A. Point A revisited. Am J Orthod 1980;77:92-6.
4. Chen YJ, Chen SK, Chang HF, Chen KC. Comparison of landmark identification in traditional versus computer-aided digital cephalometry. Angle Orthod; 70(5):387-92 (2000)
5. 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. Biomedical and Pharmacology Journal. 2019 Mar 25;12(1):341-6.
6. Sekiguchi T, Savara BS. Variability of cephalometric landmarks used for face growth studies. Am J Orthod.; 61(6):603-18 (1972).
7. Barbhuiya MH, Kumar P, Thakral R, Krishnapriya R, Bawa M. Reliability of mobile application-based cephalometric analysis for chair side evaluation of orthodontic patient in clinical practice. Journal of Orthodontic Science. 2021;10.