



## TO COMPARE AND CONTRAST THE EFFICACY OF CEPHALOMETRIC TRACINGS USING MANUAL METHOD, A SMARTPHONE APPLICATION AND COMPUTERIZED CEPHALOMETRIC TRACING SOFTWARE- A RETROSPECTIVE STUDY

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### **ABSTRACT**

#### **Objective**

The basic aim of the above study is to make a comparison in the results obtained from traditional manual tracing method with that of smartphone application cephalometric tracing and tracing with computer software. **Materials and methods** Tracing of latceph radiographs from 56 patients (28 being females, 28 being males) done manually, by a computerized software and smartphone application methods and the evaluation was done relatively by Down's analysis, Steiner's analysis and Tweed's analysis, with specific skeletal and dental measurements. The performance durations compared as well. **Results** In Downs Analysis, L1 - Occ Plane ( $^{\circ}$ ) with higher values in group 1 viz. Manual Tracing Method. In Steiner's Analysis ANB ( $^{\circ}$ ) with higher values in group 1 viz. Manual Tracing Method SNA ( $^{\circ}$ ) with higher values in group 1 viz. Manual Tracing Method Soft Tissue Convexity ( $^{\circ}$ ) with higher values in group 3 viz. Smartphone App Tracing. In Tweed's Analysis FMIA with higher values in group 3 viz. Cephalometric tracing with Smartphone App. The above parameters showed statistically significant results. **Conclusions** In spite of getting differences that were actually significant statistically, between all the three methods, the tracing was comparatively speedy in computer software and smart phone app, than that with the help of tracing manually.

#### **KEYWORDS**

Applications in smart phones, Computerized Cephalometric tracing Software

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## INTRODUCTION

Orthodontics as a speciality has evolved progressively through ages. Technology is on the forefront to make things easier. Technology which is being used at a greater pace is rapidly changing our way of living.

Cephalometry is a study and measurement of the head.

The Egyptians in traditional times, a system that was quantitative and intricate was developed, that were used to define the actual proportions of the human living body. It was then called the Canon of proportions.

Canons were initially enclosed in a grid system of equalized squares with 18 horizontal lines, line 18 drawn through hairline. Later it was then included in a grid system of 22 horizontal lines, line 21 drawn through the upper eyelid. 2

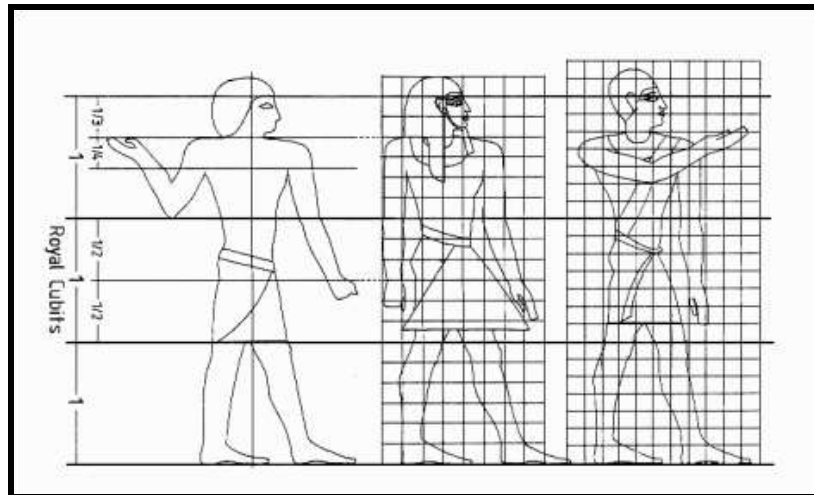


Fig. 1 Development of the Egyptian Grid System

Broadbent completed his training under angle and then joined a well known surgeon surgeon, who was also an anatomist, T.Wingate Todd who resided in Cleveland, and both of them had developed the Western Reserve University roentgenographic craniostat together with each other's help. A standardization of lateral and anteroposterior radiographs of planar type of the human mandible as well as the skull. 3-4

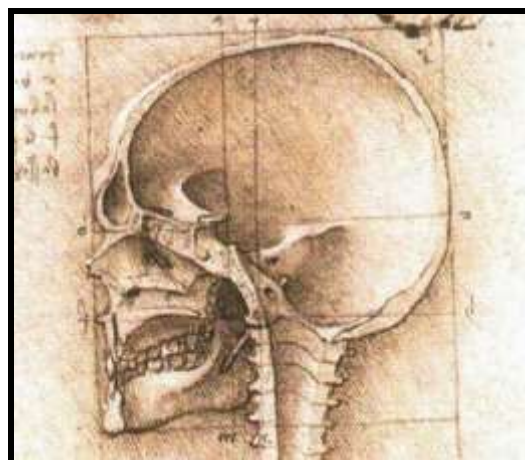


Fig. 2 Cephalometric measurements and assessments by Da Vinci

The Cephalometric analysis which is a part of the orthodontic treatment plan helps for the purpose of research clinically.

Clinicians and patients, both have equally benefited from smart phones in order to access information which is relevant orthodontically and at the click of a button, the use of these technologies can be a boon to both the orthodontists as well as patients today and in the future indeed.

It is capable of downloading various applications that are not associated with a cellular phone. The word "App" is the short form of "Application". An application is a program which is specialized. It can be downloaded on the mobile or smart phone device. It connects with the help of an internet portal. Owing to their portability, easy update, fast speed and easy access, smartphones serve as a quick reference tool.



Fig. 3 Smartphone displaying different Applications

Earlier, during the times when technological inventions were on a roll, apps were introduced for various purposes such as Daily Utility Apps, Gaming Apps, Social Networking Apps-Facebook, Twitter; Communication Apps- Whatsapp, Instagram, Snapchat, Telegram; Health & Lifestyle Apps, Banking & Financial Apps etc. Thereafter, development of many other computer or digital programs have been done for tracing by digital methods.

In these times, the technology of mobiles have become a need in our daily routine.

There has been a study which was conducted by Millward Brown in the year 2014, wherein about 30 countries of the world, these mobile devices evaluate to about 47% of the total time spent in front of the screen everyday, where 35% usages are that of smart phones.

The smartphones, are indeed powerful computer like devices held in the hand, have been serving as assistants serving for personalization of data, music players, cameras and have been also an increasing technological awareness tool.

The literature would be beneficial from more data which would be available with direct clinical applications and an answer to whether a digital cephalometric analysis usually provides a diagnostic product equivalent to the older or conventional technique. Therefore, the objective of the above study was comparison and contrasting the efficiency of cephalometric tracings, to assess the differences of angular and linear measurements of conventional, digital computer software and smartphone digital application cephalometric methods in terms of reliability of repeated measurements within each method and reproducibility of measurements between the techniques.

### **MATERIALS AND METHODS**

56 patients requiring orthodontic treatment (28 females and 28 males) and their lateral cephalometric digital radiographs with an average age of 10 to 30 years and no previous orthodontic treatment were taken from the Department of Orthodontics and Dentofacial Orthopaedics, D Y Patil University School of Dentistry, Navi Mumbai. Approval of the study by Ethics & Research Committee of D Y Patil University.

The manual, app tracings and computer software tracings were done by the same evaluator in order to decrease the measurement variability.

### **STATISTICAL ANALYSIS**

Data that was taken together over a MS Office-- Excel worksheet & analysis was done statistically with the help of SPSS software. The Frequency (n) & percentage (%), mean & Standard deviation of the data and other descriptive form of statistics of numerical data in each group had been depicted. The overall Normality of the numerical data had been evaluated using Shapiro – Wilk test or Kolmogorov-Smirnov test. Depending on the normality of data, statistical tests were determined. For a numerical continuous data following a normal distribution, comparison between two groups was done using One Way ANOVA test.

The alpha error was kept at around 5% as well as the Beta error was kept at around 20%, also the power was kept at around 80%, as well as the value  $p < 0.05$  was considered as significant statistically.

### **RESULT**

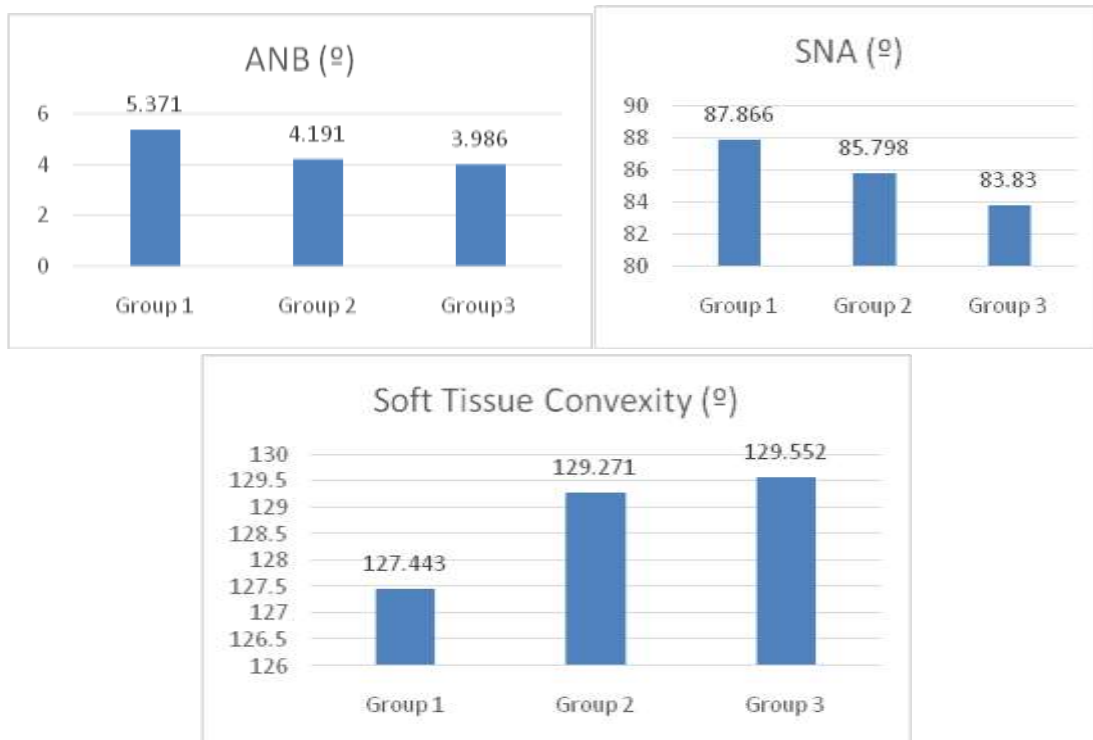
Lateral Cephalograms of 56 patients were analyzed using manual cephalometric tracing and smartphone digital application tracing. Statistically significant differences between the three tracing methods were found with • Downs Analysis ( 1 parameters) • Steiners Analysis ( 3 parameters) • Tweed Analysis ( 1 parameter).

The Downs Analysis was carried out on 56 Lateral cephalograms manually and then the values were compared to the values of the Computerized Cephalometric Tracing Software and Smartphone Application. Parameters of the Downs Analysis that showed statistically significant differences: L1 - Occ Plane ( $^{\circ}$ ) with higher values in group 1 viz. Manual Tracing





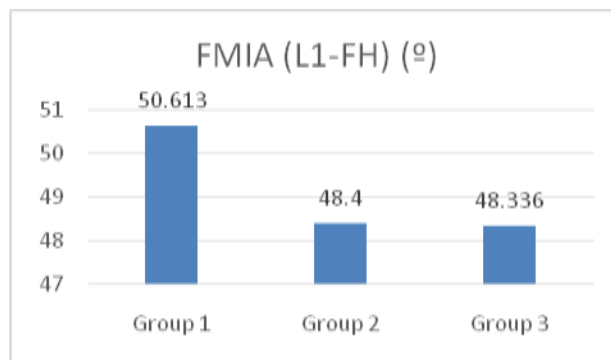
The Steiners Analysis was carried out on 56 Lateral cephalograms manually and then the values were compared to the values of the Computerized Cephalometric Tracing Software and Smartphone Application. Parameters of the Steiners Analysis that showed statistically significant differences: ANB (°) with higher values in group 1 viz. Manual Tracing Method SNA (°) with higher values in group 1 viz. Manual Tracing Method Soft Tissue Convexity (°) with higher values in group 3 viz. Smartphone App Tracing



Tweeds Analysis carried out on 56 Lateral cephalograms manually and then the values were compared to the values of the Computerized Cephalometric Tracing Software and Smartphone Application. Values that showed statistically significant differences were:

FMIA with higher values in group 3 viz. Cephalometric tracing with Smartphone App.





## DISCUSSION

The basic aim of the above study was comparison of durations of the performances and the results of tracing between the smartphone app, computer software and the manual methods of cephalometric tracings.

Applications on mobiles have been able to take the field of dentistry one step further. Different smartphone apps that are related to orthodontics are also been used by patients in addition to orthodontic clinicians.

Sheldon Baurind (1971) <sup>2</sup>, using Scattergrams showed that considerable variations occur in the locations of the points forming the Frankfort Horizontal plane i.e. the porion and orbitale. In the facial angle which gives the degrees of retrusion or protrusion of the lower jaw, certain errors of interpretations should be avoided in cases having unusual locations such as the nasion in small orbitale cavities or when anomalies lie in the temporal bone.

The study revealed that there was a statistically insignificant difference seen for the values between the groups ( $p > 0.05$ ) except for L1 - Occ Plane (°) with higher values in group 1 ANB (°) with higher values in group 1 SNA (°) with higher values in group 1 Soft Tissue Convexity (°) with higher values in group 3 FMIA (L1-FH) (°) with higher values in group 3. Where, group 1 comprised of the values traced with Manual Tracing method, group 2 comprised of the values traced with Dolphin computerized cephalometric tracing software and group 3 comprised of the values traced with CephNinja Smartphone App. Tracing was comparatively faster with the digital methods compared to the manual method.

## CONCLUSION

The Study carried out on 56 lateral cephalograms traced by two different methods showed that there were statistically significant differences seen in some parameters of the three analysis. It was witnessed that lesser time was taken to obtain the inferences of the analysis done by the smartphone digital application method and computer software tracing compared to the manual tracing method. Thus we can conclude that smartphone tracing and computer software tracing helps us save more time thus helping the Orthodontist to obtain a faster result.

The zoom-in feature of smart phones have been helping us in magnification of different required areas. Also, since the application is easily available on the Apple store, it can be downloaded and carried along anywhere. There is no special armamentarium that is required. It can be thus concluded from the study that the digital technology will indeed be a potential game changer in applications of clinical perspectives.



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